

Double Ring Test – Permeability June to November

Project Identification:		MPSA Cobre TMF					Constants	Area cm2	Depth of Liquid (cm)	Liquid Container Number		Marriotte Tube Volume		Marriotte Tube Area		
Test Location:		TMF ESD WRP1 Sand Cell NP42 (N982562, E538678 281.76m) Mechanical Sand					Inner Ring	729	15.0				3000	54		
Liquid Used:		H ₂ O	pH:	N/A		Annular Space	2189	15.0				10000	167			
Tested By:		Y. Guerra, M. González					Liquid level maintained using: () Flow Valve () Float Valve (☒) Mariotte Tubes									
Fines %:		9.9					Penetration Depth of Outer Ring: 15cm									
Trial #	Start / End	Date MM/DD/YY	Time HR:MIN	Elapsed Time Chg/(Total) Min	Inner Ring Reading cm	Flow Readings			Liquid Temp C	Infiltration Rate			Ground Temperature		Remarks	
						Inner Mariotte Tube Flow (ml)	Annular Space Reading cm	Annular Space Mariotte Tube Flow (ml)		Inner Infiltration Rate cm/h	Inner Infiltration Rate cm/s	Annular Infiltration Rate cm/h	Annular Infiltration Rate cm/s	Ground Temp Depth (cm)		Temp at Depth (c)
1	Start Test	06/13/21	0:00:00		58.4		57.1		29.7						Annual Ring H ₂ O Depth Initial: 15cm	
	End Test	06/13/21	0:00:30	0:00:30	58.1	16	56.6	84	29.7	2.659	7.386E-04	4.589	1.275E-03	31.0	26.9	Inner Ring H ₂ O Depth Initial: 15cm
2	Start Test	06/13/21	0:00:30	0:00:30	58.1		56.6		29.7							
	End Test	06/13/21	0:01:00	0:01:00	56.5	86	55.8	134	29.7	14.182	3.939E-03	7.342	2.039E-03			
3	Start Test	06/13/21	0:01:00	0:00:30	56.5		55.8		29.7							Annual Ring H ₂ O Depth Final: 2.0cm
	End Test	06/13/21	0:01:30	0:01:30	55.5	54	54.8	167	29.7	8.863	2.462E-03	9.178	2.549E-03			Inner Ring H ₂ O Depth Final: 1.2cm
4	Start Test	06/13/21	0:01:30	0:00:30	55.5		54.8		29.7							
	End Test	06/13/21	0:02:00	0:02:00	53.7	97	53.9	151	29.7	15.954	4.432E-03	8.260	2.294E-03			
5	Start Test	06/13/21	0:02:00	0:00:30	53.7		53.9		29.7							
	End Test	06/13/21	0:02:30	0:02:30	52.0	92	53.1	134	29.7	15.068	4.186E-03	7.342	2.039E-03			Weather conditions: Sunny Day, Hot weather
6	Start Test	06/13/21	0:02:30	0:00:30	52.0		53.1		29.7							
	End Test	06/13/21	0:03:00	0:03:00	50.4	86	52.2	151	29.7	14.182	3.939E-03	8.260	2.294E-03			Weather Temp: 27.4°C
7	Start Test	06/13/21	0:03:00	0:00:30	50.4		52.2		29.7							
	End Test	06/13/21	0:03:30	0:03:30	48.8	86	51.3	151	29.7	14.182	3.939E-03	8.260	2.294E-03			
8	Start Test	06/13/21	0:03:30	0:00:30	48.8		51.3		29.7							Nuclear Density Test
	End Test	06/13/21	0:04:00	0:04:00	47.3	81	50.3	167	29.7	13.295	3.693E-03	9.178	2.549E-03			
9	Start Test	06/13/21	0:04:00	0:00:30	47.3		50.3		29.7							W.D: 1686.3kg/m3
	End Test	06/13/21	0:04:30	0:04:30	45.6	92	49.4	151	29.7	15.068	4.186E-03	8.260	2.294E-03			
10	Start Test	06/13/21	0:04:30	0:00:30	45.6		49.4		29.7							D.D: 1533kg/m3
	End Test	06/13/21	0:05:00	0:05:00	44.1	81	48.4	167	29.7	13.295	3.693E-03	9.178	2.549E-03			
11	Start Test	06/13/21	0:05:00	0:00:30	44.1		48.4		29.7							M.C: 10.0%
	End Test	06/13/21	0:05:30	0:05:30	42.7	75	47.7	117	29.7	12.409	3.447E-03	6.424	1.785E-03			
12	Start Test	06/13/21	0:05:30	0:00:30	42.7		47.7		29.7							Compaction: 100.2%
	End Test	06/13/21	0:06:00	0:06:00	41.0	92	46.1	268	29.7	15.068	4.186E-03	14.684	4.079E-03			
13	Start Test	06/13/21	0:06:00	0:00:30	41.0		46.1		29.7							(Using MPSA-RT-13548 Standard Lab. Compaction M.D.D: 1530 O.M.C: 20.5%) Mechanical Sand
	End Test	06/13/21	0:06:30	0:06:30	39.5	81	45.7	67	29.7	13.295	3.693E-03	3.671	1.020E-03			
14	Start Test	06/13/21	0:06:30	0:00:30	39.5		45.7		29.7							
	End Test	06/13/21	0:07:00	0:07:00	38.1	75	44.8	151	29.7	12.409	3.447E-03	8.260	2.294E-03			
15	Start Test	06/13/21	0:07:00	0:00:30	38.1		44.8		29.7							
	End Test	06/13/21	0:07:30	0:07:30	36.6	81	43.8	167	29.7	13.295	3.693E-03	9.178	2.549E-03			
16	Start Test	06/13/21	0:07:30	0:00:30	36.6		43.8		29.7							
	End Test	06/13/21	0:08:00	0:08:00	35.1	81	42.7	184	29.7	13.295	3.693E-03	10.095	2.804E-03			
17	Start Test	06/13/21	0:08:00	0:00:30	35.1		42.7		29.7							
	End Test	06/13/21	0:08:30	0:08:30	33.7	75	41.8	151	29.7	12.409	3.447E-03	8.260	2.294E-03			
18	Start Test	06/13/21	0:08:30	0:00:30	33.7		41.8		29.7							
	End Test	06/13/21	0:09:00	0:09:00	32.2	81	40.8	167	29.7	13.295	3.693E-03	9.178	2.549E-03			
19	Start Test	06/13/21	0:09:00	0:00:30	32.2		40.8		29.7							
	End Test	06/13/21	0:09:30	0:09:30	30.8	75	39.8	167	29.7	12.409	3.447E-03	9.178	2.549E-03			
20	Start Test	06/13/21	0:09:30	0:00:30	30.8		39.8		29.7							
	End Test	06/13/21	0:10:00	0:10:00	29.4	75	38.8	167	29.7	12.409	3.447E-03	9.178	2.549E-03			
21	Start Test	06/13/21	0:10:00	0:00:30	29.4		38.8		29.7							
	End Test	06/13/21	0:10:30	0:10:30	28.0	75	37.8	167	29.7	12.409	3.447E-03	9.178	2.549E-03			
22	Start Test	06/13/21	0:10:30	0:00:30	28.0		37.8		29.7							
	End Test	06/13/21	0:11:00	0:11:00	26.5	81	36.8	167	29.7	13.295	3.693E-03	9.178	2.549E-03			
23	Start Test	06/13/21	0:11:00	0:00:30	26.5		36.8		29.7							
	End Test	06/13/21	0:11:30	0:11:30	25.1	75	35.8	167	29.7	12.409	3.447E-03	9.178	2.549E-03			
24	Start Test	06/13/21	0:11:30	0:00:30	25.1		35.8		29.7							
	End Test	06/13/21	0:12:00	0:12:00	23.7	75	34.7	184	29.7	12.409	3.447E-03	10.095	2.804E-03			
25	Start Test	06/13/21	0:12:00	0:00:30	23.7		34.7		29.7							
	End Test	06/13/21	0:12:30	0:12:30	22.3	75	33.7	167	29.7	12.409	3.447E-03	9.178	2.549E-03			
26	Start Test	06/13/21	0:12:30	0:00:30	22.3		33.7		29.7							
	End Test	06/13/21	0:13:00	0:13:00	20.9	75	32.7	167	29.7	12.409	3.447E-03	9.178	2.549E-03			
27	Start Test	06/13/21	0:13:00	0:00:30	20.9		32.7		29.7							
	End Test	06/13/21	0:13:30	0:13:30	19.5	75	31.7	167	29.7	12.409	3.447E-03	9.178	2.549E-03			
28	Start Test	06/13/21	0:13:30	0:00:30	19.5		31.7		29.7							
	End Test	06/13/21	0:14:00	0:14:00	18.1	75	30.6	184	29.7	12.409	3.447E-03	10.095	2.804E-03			
29	Start Test	06/13/21	0:14:00	0:00:30	18.1		30.6		29.7							
	End Test	06/13/21	0:14:30	0:14:30	16.6	81	29.6	167	29.7	13.295	3.693E-03	9.178	2.549E-03			
30	Start Test	06/13/21	0:14:30	0:00:30	16.6		29.6		29.7							
	End Test	06/13/21	0:15:00	0:15:00	15.4	65	28.5	184	29.7	10.636	2.954E-03	10.095	2.804E-03			
31	Start Test	06/13/21	0:15:00	0:00:30	15.4		28.5		29.7							
	End Test	06/13/21	0:15:30	0:15:30	14.0	75	27.5	167	29.7	12.409	3.447E-03	9.178	2.549E-03			
32	Start Test	06/13/21	0:15:30	0:00:30	14.0		27.5		29.7							
	End Test	06/13/21	0:16:00	0:16:00	12.6	75	26.4	184	29.7	12.409	3.447E-03	10.095	2.804E-03			
33	Start Test	11/23/20	0:16:00	0:00:30	12.6		26.4		29.7							
	End Test	11/23/20	0:16:30	0:16:30	11.2	75	25.4	167	29.7	12.409	3.447E-03	9.178	2.549E-03			
34	Start Test	11/23/20	0:16:30	0:00:30	11.2		25.4		29.7							
	End Test	11/23/20	0:17:00	0:17:00	9.8	75	24.3	184	29.7	12.409	3.447E-03	10.095	2.804E-03			
35	Start Test	11/23/20	0:17:00	0:00:30	9.8		24.3		29.7							
	End Test	11/23/20	0:17:30	0:17:30	8.4	75	23.3	167	29.7	12.409	3.447E-03	9.178	2.549E-03			
36	Start Test	11/23/20	0:17:30	0:00:30	8.4		23.3		29.7							
	End Test	11/23/20	0:18:00	0:18:00	6.9	81	22.2	184	29.7	13.295	3.693E-03	10.095	2.804E-03			
37	Start Test	11/23/20	0:18:00	0:00:30	6.9		22.2		29.7</							







Date:	14-Jun-21	Location: TMF ESD WRP1 Sand Cell N#42	N	982562
Sample ID:	MPSA-PERM-023		E	538678
Material:	Cyclone U/F Sand (Mechanically placed and compacted)		Elev.(m)	81.76m
Fines Content:	9.9%			
Source:	Sand Cycloning Plant			
Technician:	YG/MG			

Enter Data

SPECIFICATION: > 1.00E-04 cm/s

Viscosity Factor (v24/v20)= 0.5760278305

Viscosity Factor (v25/v20)= 0.5629348514

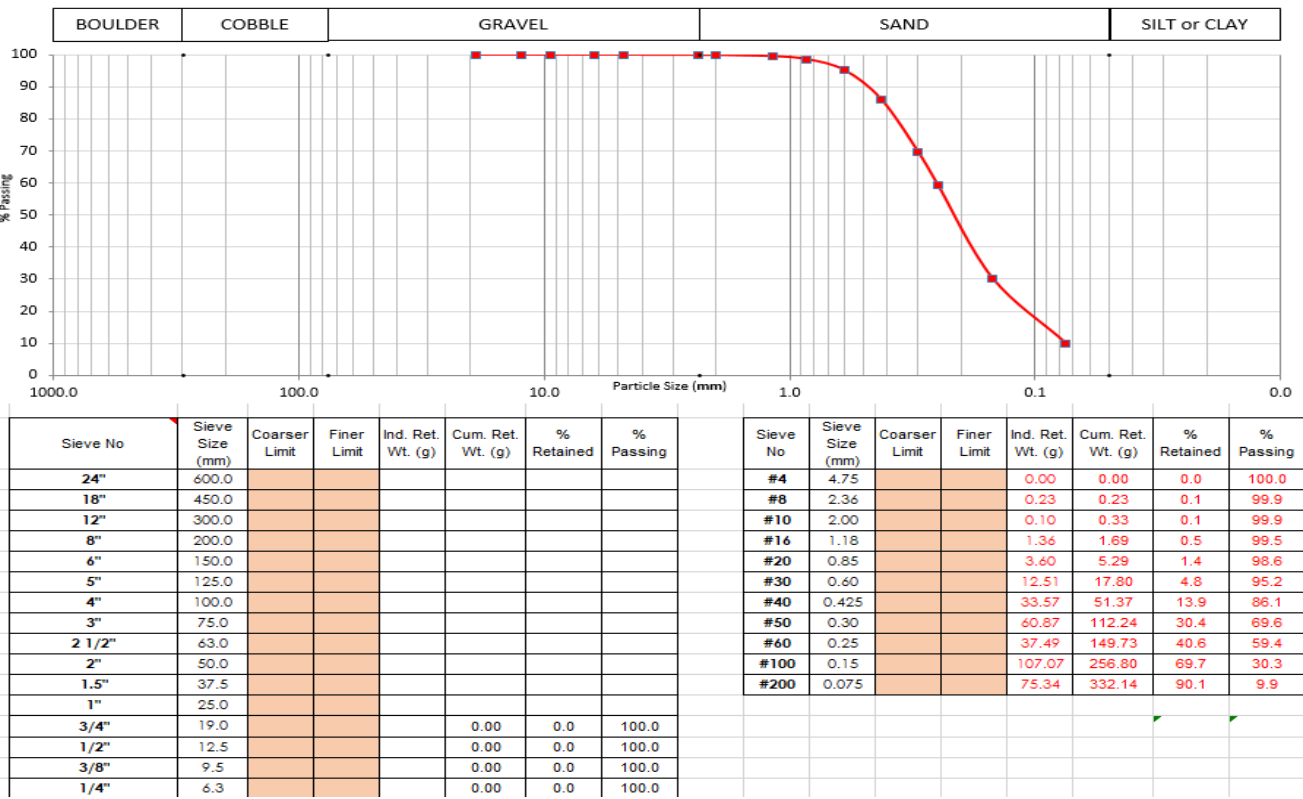
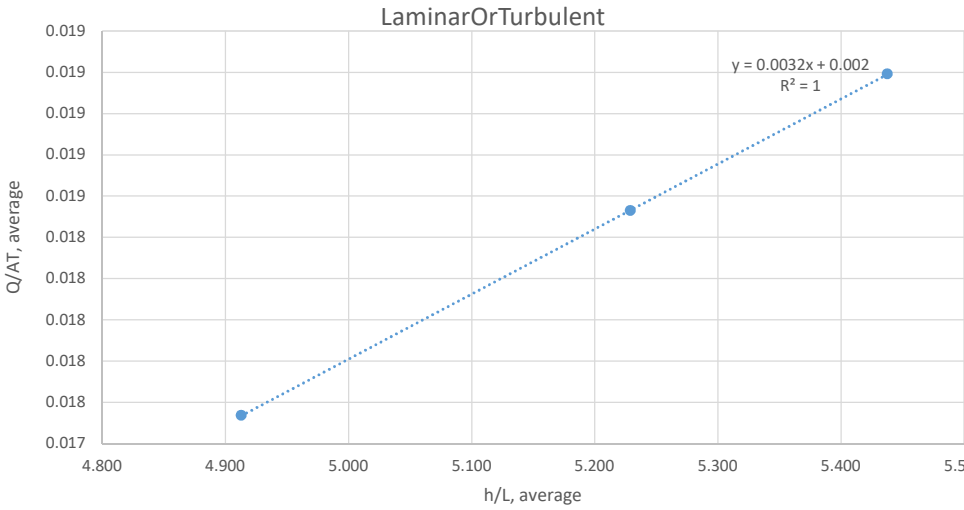
Flow Laminarity	Test	H1 (cm)	H2 (cm)	h (cm)	Q (cm3, mL)	t (s)	Q/At	Average Q/At	h/L	Average, h/L	T (°C)	k, cm/s	k, m/s	k, m/s, corrected	Average k, m/s, corrected	Average k, cm/s, corrected
0 height	1	87.7	25.4	62.3	58	30	0.019191	0.019	5.417391304	5.438	24	3.54E-03	3.54E-05	2.04054E-05	2.03295E-05	2.03E-03
	2	87.7	25.2	62.5	58	30	0.019191		5.434782609		24	3.53E-03	3.5311E-05	2.03401E-05		
	3	87.7	24.9	62.8	58	30	0.019191		5.460869565		24	3.51E-03	3.51423E-05	2.02429E-05		
Δ5cm height	4	88.8	28.9	59.9	56	30	0.018529	0.019	5.208695652	5.229	24	3.56E-03	3.55732E-05	2.04912E-05	2.04119E-05	2.04E-03
	5	88.8	28.7	60.1	56	30	0.018529		5.226086957		24	3.55E-03	3.54548E-05	2.0423E-05		
	6	88.8	28.4	60.4	56	30	0.018529		5.252173913		24	3.53E-03	3.52787E-05	2.03215E-05		
Δ10cm height	7	89.5	33	56.5	53	30	0.017536	0.018	4.913043478	4.913	25	3.57E-03	3.56935E-05	2.00931E-05	2.00931E-05	2.01E-03
	8	89.5	33	56.5	53	30	0.017536		4.913043478		25	3.57E-03	3.56935E-05	2.00931E-05		
	9	89.5	33	56.5	53	30	0.017536		4.913043478		25	3.57E-03	3.56935E-05	2.00931E-05		

MDD (g/cm3)	1.530
OMC	20.50

Area (cm2)=	100.74
Length between manometers (cm)=	11.50
Mass (perm.), g	2210.20

100% Compaction Height of Specimen (cm)	18.00
Final Height of Specimen (cm)	18.00
V (perm., cm3) at 18cm height	1813.37
Specimen Moisture Cntnt	20.40
Mass (wet) required for 6x 3cm compacted layers at 100% PRMDD	3340.45
Mass Final of Compacted Specimen	3342.00
Final Volume of Specimen (cm3)	1813.37
Dry Unit Weight	1.531
% Compaction	100.0

Void Ratio, e
Reltive Density, RD



Sample Identification		 FIRST QUANTUM MINERALS LTD. Cobre Panamá	
1	Informacion General (Informacion General)		
	Sample number (Numero de muestra):	MPSA-DRI-024	
	sampled date (Fecha de muestreo):	15-Jun-21	
2	Material Information (Informacion del Material)		
	Source (Fuente)	Sand Cycloning Plant	
	Work Area (Area de Trabajo)	TMF NSD Sec.4 Sand Cell N°24 (inplace)	
	Borrow - Foundation - Excavation - Crusher - Fill - Site Investigation - Other: Plant Prestamo - Fundacion - Excavacion - Crusher - Relleno - Investigacion de Sitio - Otro:		
	Fill Zone (specs 1824-363-CI-SPC-0003): Zona de Material:		
	Material Type Tipo de Material	Cyclone Sand (Hydraulic)	Sieve Analysis for Double Ring Infiltrometer Test-DRI-024
	Remarks: Comentarios: Received: 13:00hrs, Complete Test: 13:45hrs		
	Hydraulically Placed and Compacted.		
		Start sta.:	End Sta.:
	Coordinates - GPS or Survey (Coordenadas - GPS o Topografia):	N: 982984	E: 536066
	Depth used to estimate elevation: (Profundidad a la que se tomo la muestra):	300mm	
	Recorded Ground elevation: (Elevacion del terreno)	El. 79.44m	
Technician:	Name: YG/EG	Signature:	
Lab Supervisor:	Name: CG	Signature:	

MINA COBRE PANAMA
Material Finer than 75mic. Sieve in Soil by Washing (ASTM D1140)



Sample Type:

Cyclone Sand (Hydraulic)

Technician:

EG/RH

Sample No:

MPSA-DRI-024

Date Tested:

15-Jun-21

Source:

Sand Cycloning Plant

Date Sampled:

15-Jun-21

Location:

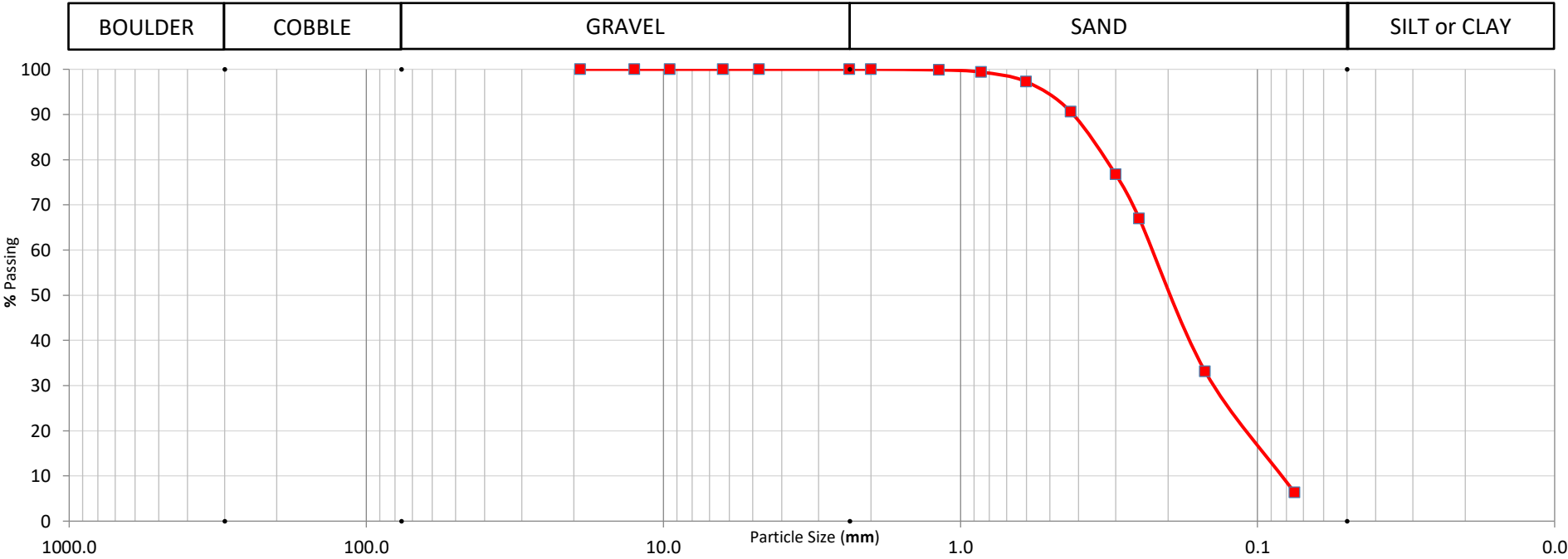
TMF NSD Sec.4 Sand Cell N°24 (inplace)

Other:

Sieve Analysis for Double Ring
Infiltrometer Test-DRI-024

Wet Weight (g):	963.23
Moisture (%):	9.1
Orig. Dry Wt. (g):	882.82
Total Solid (%):	
Washed Oven Dry Wt. (g):	227.84
Washed Loss (g):	
Specific Gravity :	

Gravel	
Sand	93.7
Fines	6.3
Fineness Modulus	2.30



Sieve No	Sieve Size (mm)	Coarser Limit	Finer Limit	Ind. Ret. Wt. (g)	Cum. Ret. Wt. (g)	% Retained	% Passing
24"	600.0						
18"	450.0						
12"	300.0						
8"	200.0						
6"	150.0						
5"	125.0						
4"	100.0						
3"	75.0						
2 1/2"	63.0						
2"	50.0						
1.5"	37.5						
1"	25.0						
3/4"	19.0				0.00	0.0	100.0
1/2"	12.5				0.00	0.0	100.0
3/8"	9.5				0.00	0.0	100.0
1/4"	6.3				0.00	0.0	100.0

Sieve No	Sieve Size (mm)	Coarser Limit	Finer Limit	Ind. Ret. Wt. (g)	Cum. Ret. Wt. (g)	% Retained	% Passing
#4	4.75			0.00	0.00	0.0	100.0
#8	2.36			0.00	0.00	0.0	100.0
#10	2.00			0.00	0.00	0.0	100.0
#16	1.18			1.28	1.28	0.1	99.9
#20	0.85			4.35	5.63	0.6	99.4
#30	0.60			18.78	24.41	2.8	97.2
#40	0.425			58.88	83.29	9.4	90.6
#50	0.30			122.57	205.86	23.3	76.7
#60	0.25			86.04	291.90	33.1	66.9
#100	0.15			298.75	590.65	66.9	33.1
#200	0.075			236.71	827.36	93.7	6.3

Project Identification:		MPSA Cobre TMF					Constants	Area cm2	Depth of Liquid (cm)	Liquid Container Number		Marriotte Tube Volume		Marriotte Tube Area		
Test Location:		TMF NSD Sec 4 Sand Cell N°24 (N982984, E536066 279.44m) Hydraulic Sand					Inner Ring	729	15.0			3000	54			
Liquid Used:		H ₂ O	pH:	N/A		Annular Space	2189	15.0			10000	167				
Tested By:		Y. Guerra, E. González					Liquid level maintained using: () Flow Valve () Float Valve (☒) Mariotte Tubes									
Fines %:		6.3					Penetration Depth of Outer Ring: 15cm									
Trial #	Start / End	Date MM/DD/YY	Time HR:MIN	Elapsed Time Chg/(Total) Min	Inner Ring Reading cm	Flow Readings			Liquid Temp C	Infiltration Rate			Ground Temperature		Remarks	
						Inner Mariotte Tube Flow (ml)	Annular Space Reading cm	Annular Space Mariotte Tube Flow (ml)		Inner Infiltration Rate cm/h	Inner Infiltration Rate cm/s	Annular Infiltration Rate cm/h	Annular Infiltration Rate cm/s	Ground Temp Depth (cm)		Temp at Depth (c)
1	Start Test	06/15/21	0:00:00		58.2		57.8		28.4						Annual Ring H ₂ O Depth Initial: 15cm	
	End Test	06/15/21	0:00:30	0:00:30	55.2	162	56.5	218	28.4	26.590	7.386E-03	11.931	3.314E-03	30.0	28.2	Inner Ring H ₂ O Depth Initial: 15cm
2	Start Test	06/15/21	0:00:30	0:00:30	55.2		56.5		28.4							
	End Test	06/15/21	0:01:00	0:01:00	53.4	97	55.5	167	28.4	15.954	4.432E-03	9.178	2.549E-03			
3	Start Test	06/15/21	0:01:00	0:00:30	53.4		55.5		28.4							Annual Ring H ₂ O Depth Final: 4.0cm
	End Test	06/15/21	0:01:30	0:01:30	50.6	151	54.6	151	28.4	24.818	6.894E-03	8.260	2.294E-03			Inner Ring H ₂ O Depth Final: 1.0cm
4	Start Test	06/15/21	0:01:30	0:00:30	50.6		54.6		28.4							
	End Test	06/15/21	0:02:00	0:02:00	47.6	162	53.6	167	28.4	26.590	7.386E-03	9.178	2.549E-03			
5	Start Test	06/15/21	0:02:00	0:00:30	47.6		53.6		28.4							
	End Test	06/15/21	0:02:30	0:02:30	45.1	135	52.6	167	28.4	22.159	6.155E-03	9.178	2.549E-03			Weather conditions: Sunny Day, Hot weather
6	Start Test	06/15/21	0:02:30	0:00:30	45.1		52.6		28.4							
	End Test	06/15/21	0:03:00	0:03:00	42.5	140	51.5	184	28.4	23.045	6.401E-03	10.095	2.804E-03			Weather Temp: 31.8°C
7	Start Test	06/15/21	0:03:00	0:00:30	42.5		51.5		28.4							
	End Test	06/15/21	0:03:30	0:03:30	39.8	145	50.5	167	28.4	23.931	6.648E-03	9.178	2.549E-03			
8	Start Test	06/15/21	0:03:30	0:00:30	39.8		50.5		28.4							Nuclear Density Test
	End Test	06/15/21	0:04:00	0:04:00	37.2	140	49.4	184	28.4	23.045	6.401E-03	10.095	2.804E-03			
9	Start Test	06/15/21	0:04:00	0:00:30	37.2		49.4		28.4							W.D: 1775.1kg/m3
	End Test	06/15/21	0:04:30	0:04:30	35.0	118	48.2	201	28.4	19.500	5.417E-03	11.013	3.059E-03			
10	Start Test	06/15/21	0:04:30	0:00:30	35.0		48.2		28.4							D.D: 1633kg/m3
	End Test	06/15/21	0:05:00	0:05:00	34.6	22	47.2	167	28.4	3.545	9.848E-04	9.178	2.549E-03			
11	Start Test	06/15/21	0:05:00	0:00:30	34.6		47.2		28.4							M.C: 20.5%
	End Test	06/15/21	0:05:30	0:05:30	32.5	113	46.0	201	28.4	18.613	5.170E-03	11.013	3.059E-03			
12	Start Test	06/15/21	0:05:30	0:00:30	32.5		46.0		28.4							Compaction: 105.3%
	End Test	06/15/21	0:06:00	0:06:00	28.4	221	44.9	184	28.4	36.340	1.009E-02	10.095	2.804E-03			
13	Start Test	06/15/21	0:06:00	0:00:30	28.4		44.9		28.4							(Using MPSA-RT-12529 Standard Lab. Compaction M.D.D: 1551 O.M.C: 20.5%) Hydraulic Sand
	End Test	06/15/21	0:06:30	0:06:30	26.6	97	43.8	184	28.4	15.954	4.432E-03	10.095	2.804E-03			
14	Start Test	06/15/21	0:06:30	0:00:30	26.6		43.8		28.4							
	End Test	06/15/21	0:07:00	0:07:00	24.5	113	42.7	184	28.4	18.613	5.170E-03	10.095	2.804E-03			
15	Start Test	06/15/21	0:07:00	0:00:30	24.5		42.7		28.4							
	End Test	06/15/21	0:07:30	0:07:30	22.6	102	41.5	201	28.4	16.841	4.678E-03	11.013	3.059E-03			
16	Start Test	06/15/21	0:07:30	0:00:30	22.6		41.5		28.4							
	End Test	06/15/21	0:08:00	0:08:00	20.5	113	40.2	218	28.4	18.613	5.170E-03	11.931	3.314E-03			
17	Start Test	06/15/21	0:08:00	0:00:30	20.5		40.2		28.4							
	End Test	06/15/21	0:08:30	0:08:30	18.7	97	39.1	184	28.4	15.954	4.432E-03	10.095	2.804E-03			
18	Start Test	06/15/21	0:08:30	0:00:30	18.7		39.1		28.4							
	End Test	06/15/21	0:09:00	0:09:00	16.8	102	37.9	201	28.4	16.841	4.678E-03	11.013	3.059E-03			
19	Start Test	06/15/21	0:09:00	0:00:30	16.8		37.9		28.4							
	End Test	06/15/21	0:09:30	0:09:30	14.9	102	36.6	218	28.4	16.841	4.678E-03	11.931	3.314E-03			
20	Start Test	06/15/21	0:09:30	0:00:30	14.9		36.6		28.4							
	End Test	06/15/21	0:10:00	0:10:00	12.9	108	35.3	218	28.4	17.727	4.924E-03	11.931	3.314E-03			
21	Start Test	06/15/21	0:10:00	0:00:30	12.9		35.3		28.4							
	End Test	06/15/21	0:10:30	0:10:30	11.4	81	34.0	218	28.4	13.295	3.693E-03	11.931	3.314E-03			
22	Start Test	06/15/21	0:10:30	0:00:30	11.4		34.0		28.4							
	End Test	06/15/21	0:11:00	0:11:00	9.2	118	32.7	218	28.4	19.500	5.417E-03	11.931	3.314E-03			
23	Start Test	06/15/21	0:11:00	0:00:30	9.2		32.7		28.4							
	End Test	06/15/21	0:11:30	0:11:30	7.2	108	31.4	218	28.4	17.727	4.924E-03	11.931	3.314E-03			
24	Start Test	06/15/21	0:11:30	0:00:30	7.2		31.4		28.4							
	End Test	06/15/21	0:12:00	0:12:00	5.1	113	30.0	234	28.4	18.613	5.170E-03	12.849	3.569E-03			
25	Start Test	06/15/21	0:12:00	0:00:30	5.1		30.0		28.4							
	End Test	06/15/21	0:12:30	0:12:30	3.8	70	28.9	184	28.4	11.523	3.201E-03	10.095	2.804E-03			
26	Start Test	06/15/21	0:12:30	0:00:30	3.8		28.9		28.4							
	End Test	06/15/21	0:13:00	0:13:00	1.5	124	27.5	234	28.4	20.386	5.663E-03	12.849	3.569E-03			
27	Start Test	06/15/21	0:13:00	0:00:30	20.9		32.7		28.4							
	End Test	06/15/21	0:13:30	0:13:30	19.5	75	31.7	167	28.4	12.409	3.447E-03	9.178	2.549E-03			
28	Start Test	06/15/21	0:13:30	0:00:30	19.5		31.7		28.4							
	End Test	06/15/21	0:14:00	0:14:00	18.1	75	30.6	184	28.4	12.409	3.447E-03	10.095	2.804E-03			
29	Start Test	06/15/21	0:14:00	0:00:30	18.1		30.6		28.4							
	End Test	06/15/21	0:14:30	0:14:30	16.6	81	29.6	167	28.4	13.295	3.693E-03	9.178	2.549E-03			
30	Start Test	06/15/21	0:14:30	0:00:30	16.6		29.6		28.4							
	End Test	06/15/21	0:15:00	0:15:00	15.4	65	28.5	184	28.4	10.636	2.954E-03	10.095	2.804E-03			
31	Start Test	06/15/21	0:15:00	0:00:30	15.4		28.5		28.4							
	End Test	06/15/21	0:15:30	0:15:30	14.0	75	27.5	167	28.4	12.409	3.447E-03	9.178	2.549E-03			
32	Start Test	06/15/21	0:15:30	0:00:30	14.0		27.5		28.4							
	End Test	06/15/21	0:16:00	0:16:00	12.6	75	26.4	184	28.4	12.409	3.447E-03	10.095	2.804E-03			
33	Start Test	11/23/20	0:16:00	0:00:30	12.6		26.4		28.4							
	End Test	11/23/20	0:16:30	0:16:30	11.2	75	25.4	167	28.4	12.409	3.447E-03	9.178	2.549E-03			
34	Start Test	11/23/20	0:16:30	0:00:30	11.2		25.4		28.4							
	End Test	11/23/20	0:17:00	0:17:00	9.8	75	24.3	184	28.4	12.409	3.447E-03	10.095	2.804E-03			
35	Start Test	11/23/20	0:17:00	0:00:30	9.8		24.3		28.4							
	End Test	11/23/20	0:17:30	0:17:30	8.4	75	23.3	167	28.4	12.409	3.447E-03	9.178	2.549E-03			
36	Start Test	11/23/20	0:17:30	0:00:30	8.4		23.3		28.4							
	End Test	11/23/20	0:18:00	0:18:00	6.9	81	22.2	184	28.4	13.295	3.693E-03	10.095	2.804E-03	</		



Sl. No.	Date	Time	Location	Instrument	Reading	Remarks
1	2023-10-27	10:30	Site A	DMM	284	Initial reading
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Date:	20-Jun-21	Location: TMF NSD Sec.4 Sand Cell N#42		N	982984
Sample ID:	MPSA-PERM-024			E	536066
Material:	Cyclone U/F Sand (Hydraulic Placement)			Elev.(m)	79.44m
Fines Content:	6.3%				
Source:	Sand Cycloning Plant				
Technician:	YG				

Enter Data

SPECIFICATION: > 1.00E-04 cm/s

Viscosity Factor (v22/v20)=	0.6036685642
Viscosity Factor (v24/v20)=	0.5760278305
Viscosity Factor (v25/v20)=	0.5629348514

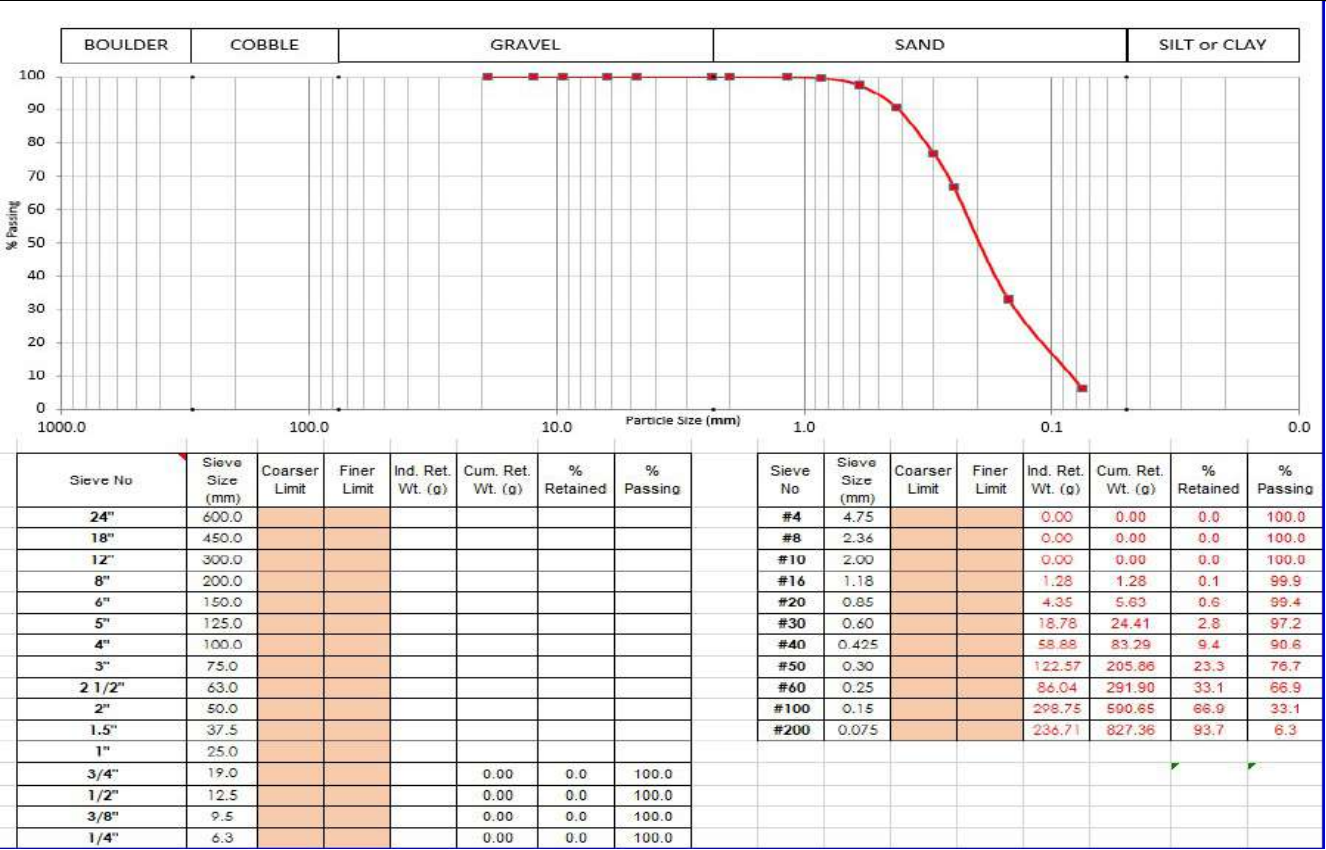
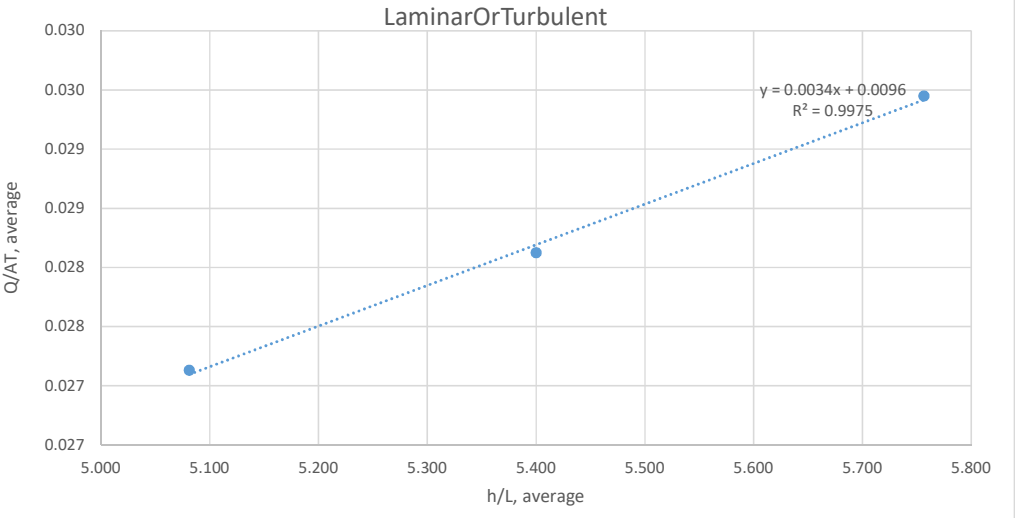
Flow Laminarity	Test	H1 (cm)	H2 (cm)	h (cm)	Q (cm3, mL)	t (s)	Q/At	Average Q/At	h/L	Average, h/L	T (°C)	k, cm/s	k, m/s	k, m/s, corrected	Average k, m/s, corrected	Average k, cm/s, corrected
0 height	1	89.4	23	66.4	89	30	0.029448	0.029	5.773913043	5.757	22	5.10E-03	5.10016E-05	3.07881E-05	3.08816E-05	3.09E-03
	2	89.4	23	66.4	89	30	0.029448		5.773913043		22	5.10E-03	5.10016E-05	3.07881E-05		
	3	88.8	23	65.8	89	30	0.029448		5.72173913		22	5.15E-03	5.14666E-05	3.10688E-05		
Δ5cm height	4	89.2	27.1	62.1	85	30	0.028124	0.028	5.4	5.400	25	5.21E-03	5.20822E-05	2.93189E-05	2.93189E-05	2.932E-03
	5	89.2	27.1	62.1	85	30	0.028124		5.4		25	5.21E-03	5.20822E-05	2.93189E-05		
	6	89.2	27.1	62.1	85	30	0.028124		5.4		25	5.21E-03	5.20822E-05	2.93189E-05		
Δ10cm height	7	90.1	31.7	58.4	82	30	0.027132	0.027	5.07826087	5.081	25	5.34E-03	5.34272E-05	3.00761E-05	3.00589E-05	3.01E-03
	8	90.1	31.7	58.4	82	30	0.027132		5.07826087		25	5.34E-03	5.34272E-05	3.00761E-05		
	9	90.1	31.6	58.5	82	30	0.027132		5.086956522		25	5.33E-03	5.33359E-05	3.00246E-05		

MDD (g/cm3)	1.551
OMC	20.50

Area (cm2)=	100.74
Length between manometers (cm)=	11.50
Mass (perm.), g	2203.94

100% Compaction Height of Specimen (cm)	18.00
Final Height of Specimen (cm)	18.00
V (perm., cm3) at 18cm height	1813.37
Specimen Moisture Cntnt	20.30
Mass (wet) required for 6x 3cm compacted layers at 100% PRMDD	3383.49
Mass Final of Compacted Specimen	3386.16
Final Volume of Specimen (cm3)	1813.37
Dry Unit Weight	1.552
% Compaction	100.1

Void Ratio, e
Reltive Density, RD



Sample Identification		 FIRST QUANTUM MINERALS LTD. Cobre Panamá	
1	Informacion General (Informacion General)		
	Sample number (Numero de muestra):	MPSA-DRI-025	
	sampled date (Fecha de muestreo):	22-Aug-21	
2	Material Information (Informacion del Material)		
	Source (Fuente)	Sand Cycloning Plant	
	Work Area (Area de Trabajo)	TMF NSD Sec.3 Sand Cell N°18 (inplace)	
	Borrow - Foundation - Excavation - Crusher - Fill - Site Investigation - Other: Plant Prestamo - Fundacion - Excavacion - Crusher - Relleno - Investigacion de Sitio - Otro:		
	Fill Zone (specs 1824-363-CI-SPC-0003): Zona de Material:		
	Material Type Tipo de Material	Cyclone Sand (Hydraulic)	Sieve Analysis for Double Ring Infiltrometer Test-DRI-025
	Remarks: Comentarios: Received: 13:00hrs, Complete Test: 13:28hrs (27.08.2021)		
	Hydraulically Placed and Compacted.		
		Start sta.:	End Sta.:
	Coordinates - GPS or Survey (Coordenadas - GPS o Topografia):	N: 983126	E: 536570
	Depth used to estimate elevation: (Profundidad a la que se tomo la muestra):		
	Recorded Ground elevation: (Elevacion del terreno)	El. 64.18m	
Technician:	Name: JC/AP/DB	Signature:	
Lab Supervisor:	Name: CG	Signature:	

Form No. 1824-QC-LST-057 Rv02 Dual language

MINA COBRE PANAMA
Material Finer than 75mic. Sieve in Soil by Washing (ASTM D1140)



Sample Type: Cyclone Sand (Hydraulic)

Technician: EL/RH

Sample No: MPSA-DRI-025

Date Tested: 27-Aug-21

Source: Sand Cycloning Plant

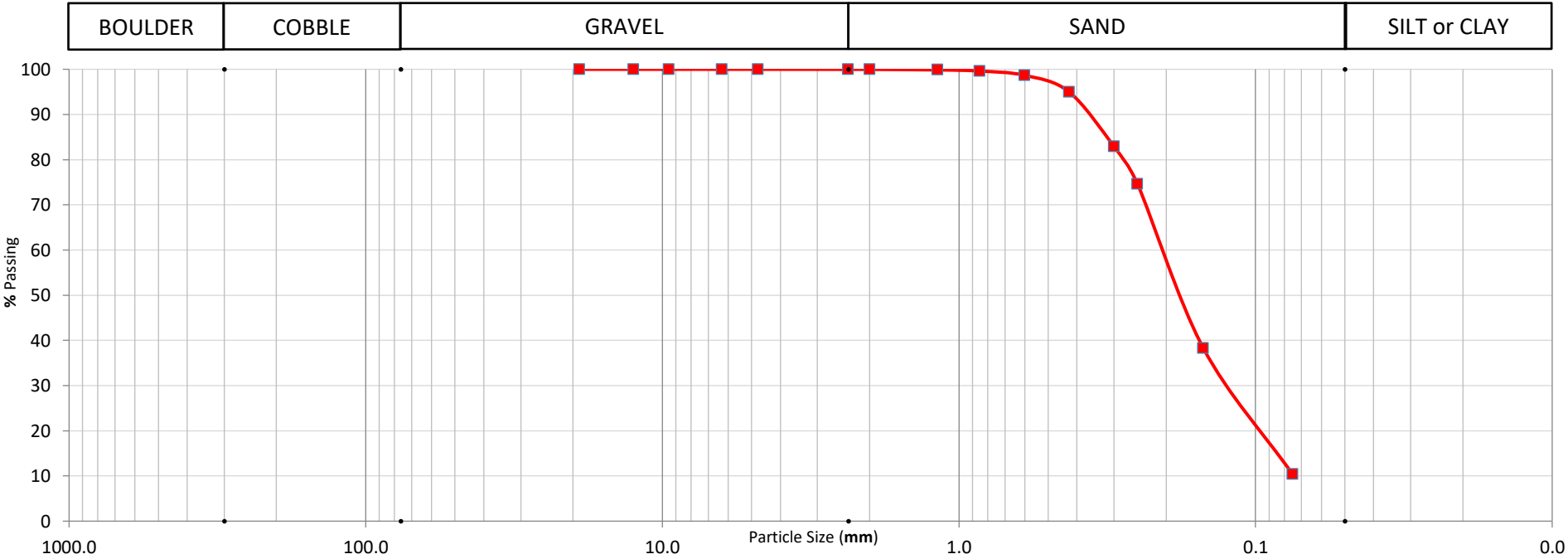
Date Sampled: 22-Aug-21

Location: TMF NSD Sec.3 Sand Cell N°18 (inplace)

Other: Sieve Analysis for Double Ring Infiltrometer Test-DRI-025

Wet Weight (g):	982.79
Moisture (%):	8.3
Orig. Dry Wt. (g):	907.45
Total Solid (%):	
Washed Oven Dry Wt. (g):	227.84
Washed Loss (g):	
Specific Gravity :	

Gravel	
Sand	89.6
Fines	10.4
Fineness Modulus	2.01



Sieve No	Sieve Size (mm)	Coarser Limit	Finer Limit	Ind. Ret. Wt. (g)	Cum. Ret. Wt. (g)	% Retained	% Passing
24"	600.0						
18"	450.0						
12"	300.0						
8"	200.0						
6"	150.0						
5"	125.0						
4"	100.0						
3"	75.0						
2 1/2"	63.0						
2"	50.0						
1.5"	37.5						
1"	25.0						
3/4"	19.0				0.00	0.0	100.0
1/2"	12.5				0.00	0.0	100.0
3/8"	9.5				0.00	0.0	100.0
1/4"	6.3				0.00	0.0	100.0

Sieve No	Sieve Size (mm)	Coarser Limit	Finer Limit	Ind. Ret. Wt. (g)	Cum. Ret. Wt. (g)	% Retained	% Passing
#4	4.75			0.00	0.00	0.0	100.0
#8	2.36			0.14	0.14	0.0	100.0
#10	2.00			0.10	0.24	0.0	100.0
#16	1.18			1.04	1.28	0.1	99.9
#20	0.85			2.27	3.55	0.4	99.6
#30	0.60			8.62	12.17	1.3	98.7
#40	0.425			33.36	45.53	5.0	95.0
#50	0.30			109.89	155.42	17.1	82.9
#60	0.25			75.12	230.54	25.4	74.6
#100	0.15			329.47	560.01	61.7	38.3
#200	0.075			253.20	813.21	89.6	10.4

Project Identification:		MPSA Cobre TMF					Constants		Area cm2	Depth of Liquid (cm)	Liquid Container Number		Marriotte Tube Volume		Marriotte Tube Area	
Test Location:		TMF NSD Sec 3 Sand Cell N°18 (N983126, E536570 254.18m) Hydraulic Sand					Inner Ring		729	15.0			3000		54	
Liquid Used:		H ₂ O	pH:	N/A			Annular Space		2189	15.0			10000		167	
Tested By:		J. Cumbra, D. Barrios, A. Perez					Liquid level maintained using: () Flow Valve () Float Valve (X) Marriotte Tubes									
Fines %:		6.3					Penetration Depth of Outer Ring: 15cm									
Trial #	Start / End	Date MM/DD/YY	Time HR:MIN	Elapsed Time Chg(Total) Min	Flow Readings				Liquid Temp C	Infiltration Rate				Ground Temperature		Remarks
					Inner Ring Reading cm	Inner Marriotte Tube Flow (ml)	Annular Space Reading cm	Annular Space Marriotte Tube Flow (ml)		Inner Infiltration Rate cm/h	Inner Infiltration Rate cm/s	Annular Infiltration Rate cm/h	Annular Infiltration Rate cm/s	Ground Temp Depth (cm)	Temp at Depth (c)	
1	Start Test	08/22/21	0:00:00		56.2		57.0		28.4							Annual Ring H ₂ O Depth Initial: 15cm Inner Ring H ₂ O Depth Initial: 15cm
	End Test	08/22/21	0:00:30	0:00:30	54.8	75	55.2	301	28.4	12.409	3.447E-03	16.520	4.589E-03	30.0	28.2	
2	Start Test	08/22/21	0:00:30	0:00:30	54.8		55.2		28.4							Annual Ring H ₂ O Depth Final: 1.0cm Inner Ring H ₂ O Depth Final: 1.0cm
	End Test	08/22/21	0:01:00	0:01:00	51.6	172	53.4	301	28.4	28.363	7.879E-03	16.520	4.589E-03			
3	Start Test	08/22/21	0:01:00	0:00:30	51.6		53.4		28.4							Annual Ring H ₂ O Depth Final: 1.0cm Inner Ring H ₂ O Depth Final: 1.0cm
	End Test	08/22/21	0:01:30	0:01:30	49.5	113	52.4	167	28.4	18.613	5.170E-03	9.178	2.549E-03			
4	Start Test	08/22/21	0:01:30	0:00:30	49.5		52.4		28.4							Weather conditions: Sunny Day, Hot weather
	End Test	08/22/21	0:02:00	0:02:00	47.3	118	51.0	234	28.4	19.500	5.417E-03	12.849	3.569E-03			
5	Start Test	08/22/21	0:02:00	0:00:30	47.3		51.0		28.4							Weather conditions: Sunny Day, Hot weather
	End Test	08/22/21	0:02:30	0:02:30	45.5	97	50.1	151	28.4	15.954	4.432E-03	8.260	2.294E-03			
6	Start Test	08/22/21	0:02:30	0:00:30	45.5		50.1		28.4							Weather Temp: 29.0°C
	End Test	08/22/21	0:03:00	0:03:00	43.7	97	48.9	201	28.4	15.954	4.432E-03	11.013	3.059E-03			
7	Start Test	08/22/21	0:03:00	0:00:30	43.7		48.9		28.4							Nuclear Density Test
	End Test	08/22/21	0:03:30	0:03:30	41.8	102	47.8	184	28.4	16.841	4.678E-03	10.095	2.804E-03			
8	Start Test	08/22/21	0:03:30	0:00:30	41.8		47.8		28.4							W.D: 1741.1kg/m3
	End Test	08/22/21	0:04:00	0:04:00	39.8	108	46.7	184	28.4	17.727	4.924E-03	10.095	2.804E-03			
9	Start Test	08/22/21	0:04:00	0:00:30	39.8		46.7		28.4							D.D: 1593kg/m3
	End Test	08/22/21	0:04:30	0:04:30	37.6	118	45.5	201	28.4	19.500	5.417E-03	11.013	3.059E-03			
10	Start Test	08/22/21	0:04:30	0:00:30	37.6		45.5		28.4							M.C: 9.3%
	End Test	08/22/21	0:05:00	0:05:00	36.4	65	44.6	151	28.4	10.636	2.954E-03	8.260	2.294E-03			
11	Start Test	08/22/21	0:05:00	0:00:30	36.4		44.6		28.4							Compaction: 101.4%
	End Test	08/22/21	0:05:30	0:05:30	34.9	81	43.3	218	28.4	13.295	3.693E-03	11.931	3.314E-03			
12	Start Test	08/22/21	0:05:30	0:00:30	34.9		43.3		28.4							(Using MPSA-RT-16206 Standard Lab. Compaction M.D.D: 1571 O.M.C: 17.9%) Hydraulic Sand
	End Test	08/22/21	0:06:00	0:06:00	32.8	113	42.5	134	28.4	18.613	5.170E-03	7.342	2.039E-03			
13	Start Test	08/22/21	0:06:00	0:00:30	32.8		42.5		28.4							(Using MPSA-RT-16206 Standard Lab. Compaction M.D.D: 1571 O.M.C: 17.9%) Hydraulic Sand
	End Test	08/22/21	0:06:30	0:06:30	31.0	97	41.6	151	28.4	15.954	4.432E-03	8.260	2.294E-03			
14	Start Test	08/22/21	0:06:30	0:00:30	31.0		41.6		28.4							Compaction: 101.4%
	End Test	08/22/21	0:07:00	0:07:00	29.7	70	40.5	184	28.4	11.523	3.201E-03	10.095	2.804E-03			
15	Start Test	08/22/21	0:07:00	0:00:30	29.7		40.5		28.4							Compaction: 101.4%
	End Test	08/22/21	0:07:30	0:07:30	28.5	65	39.6	151	28.4	10.636	2.954E-03	8.260	2.294E-03			
16	Start Test	08/22/21	0:07:30	0:00:30	28.5		39.6		28.4							Compaction: 101.4%
	End Test	08/22/21	0:08:00	0:08:00	27.3	65	38.7	151	28.4	10.636	2.954E-03	8.260	2.294E-03			
17	Start Test	08/22/21	0:08:00	0:00:30	27.3		38.7		28.4							Compaction: 101.4%
	End Test	08/22/21	0:08:30	0:08:30	25.4	102	37.6	184	28.4	16.841	4.678E-03	10.095	2.804E-03			
18	Start Test	08/22/21	0:08:30	0:00:30	25.4		37.6		28.4							Compaction: 101.4%
	End Test	08/22/21	0:09:00	0:09:00	24.0	75	36.5	184	28.4	12.409	3.447E-03	10.095	2.804E-03			
19	Start Test	08/22/21	0:09:00	0:00:30	24.0		36.5		28.4							Compaction: 101.4%
	End Test	08/22/21	0:09:30	0:09:30	22.8	65	35.4	184	28.4	10.636	2.954E-03	10.095	2.804E-03			
20	Start Test	08/22/21	0:09:30	0:00:30	22.8		35.4		28.4							Compaction: 101.4%
	End Test	08/22/21	0:10:00	0:10:00	21.5	70	34.7	117	28.4	11.523	3.201E-03	6.424	1.785E-03			
21	Start Test	08/22/21	0:10:00	0:00:30	21.5		34.7		28.4							Compaction: 101.4%
	End Test	08/22/21	0:10:30	0:10:30	19.8	92	33.6	184	28.4	15.068	4.186E-03	10.095	2.804E-03			
22	Start Test	08/22/21	0:10:30	0:00:30	19.8		33.6		28.4							Compaction: 101.4%
	End Test	08/22/21	0:11:00	0:11:00	18.2	86	32.8	134	28.4	14.182	3.939E-03	7.342	2.039E-03			
23	Start Test	08/22/21	0:11:00	0:00:30	18.2		32.8		28.4							Compaction: 101.4%
	End Test	08/22/21	0:11:30	0:11:30	16.9	70	31.6	201	28.4	11.523	3.201E-03	11.013	3.059E-03			
24	Start Test	08/22/21	0:11:30	0:00:30	16.9		31.6		28.4							Compaction: 101.4%
	End Test	08/22/21	0:12:00	0:12:00	15.3	86	30.3	218	28.4	14.182	3.939E-03	11.931	3.314E-03			
25	Start Test	08/22/21	0:12:00	0:00:30	15.3		30.3		28.4							Compaction: 101.4%
	End Test	08/22/21	0:12:30	0:12:30	14.0	70	29.7	100	28.4	11.523	3.201E-03	5.507	1.530E-03			
26	Start Test	08/22/21	0:12:30	0:00:30	14.0		29.7		28.4							Compaction: 101.4%
	End Test	08/22/21	0:13:00	0:13:00	12.9	59	28.7	167	28.4	9.750	2.708E-03	9.178	2.549E-03			
27	Start Test	08/22/21	0:13:00	0:00:30	12.9		28.7		28.4							Compaction: 101.4%
	End Test	08/22/21	0:13:30	0:13:30	11.6	70	27.8	151	28.4	11.523	3.201E-03	8.260	2.294E-03			
28	Start Test	08/22/21	0:13:30	0:00:30	11.6		27.8		28.4							Compaction: 101.4%
	End Test	08/22/21	0:14:00	0:14:00	10.5	59	26.9	151	28.4	9.750	2.708E-03	8.260	2.294E-03			
29	Start Test	08/22/21	0:14:00	0:00:30	10.5		26.9		28.4							Compaction: 101.4%
	End Test	08/22/21	0:14:30	0:14:30	9.1	75	26.0	151	28.4	12.409	3.447E-03	8.260	2.294E-03			



Date:	22-Aug-21	Location: TMF NSD Sec.3 Sand Cell N°18		N	983126
Sample ID:	MPSA-PERM-025			E	536570
Material:	Cyclone U/F Sand (Hydraulic Placement)			Elev.(m)	64.18m
Fines Content:	10.4%				
Source:	Sand Cycloning Plant				
Technician:	YG	Date Tested	28-Aug-21		

Enter Data

SPECIFICATION: > 1.00E-04 cm/s

Viscosity Factor (v24/v20)=	0.5760278305
Viscosity Factor (v25/v20)=	0.5629348514
Viscosity Factor (v26/v20)=	0.5503478811

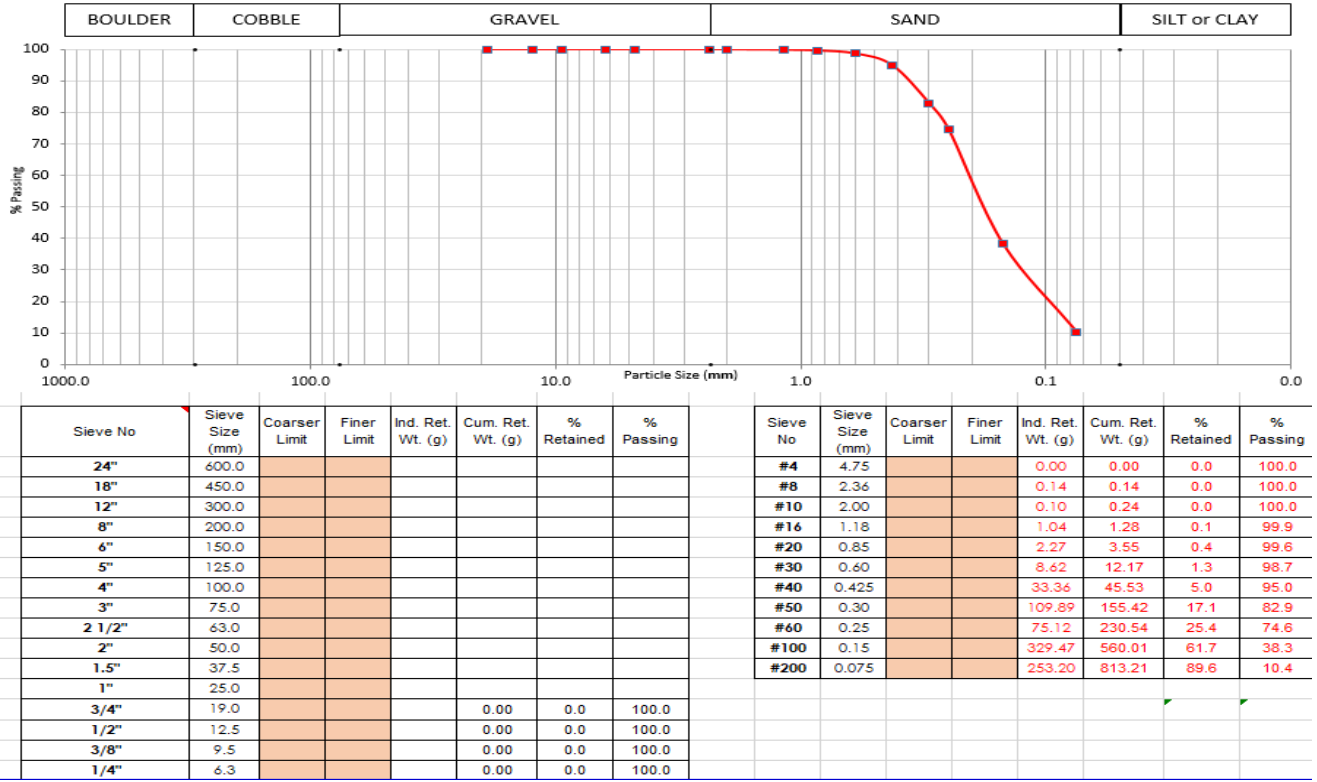
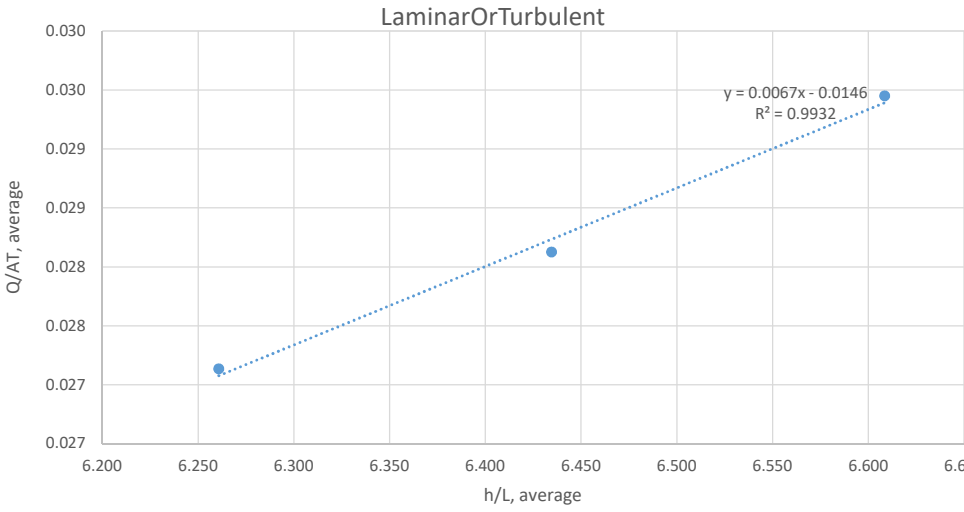
Flow Laminarity	Test	H1 (cm)	H2 (cm)	h (cm)	Q (cm3, mL)	t (s)	Q/At	Average Q/At	h/L	Average, h/L	T (°C)	k, cm/s	k, m/s	k, m/s, corrected	Average k, m/s, corrected	Average k, cm/s, corrected
0 height	1	79.9	22.1	76	89	30	0.029448	0.029	6.608695652	6.609	24	4.46E-03	4.45593E-05	2.56674E-05	2.56674E-05	2.57E-03
	2	80	22.1	76	89	30	0.029448		6.608695652		24	4.46E-03	4.45593E-05	2.56674E-05		
	3	79.9	22.2	76	89	30	0.029448		6.608695652		24	4.46E-03	4.45593E-05	2.56674E-05		
Δ5cm height	4	80.6	26	74	85	30	0.028124	0.028	6.434782609	6.435	24	4.37E-03	4.37068E-05	2.40539E-05	2.40539E-05	2.405E-03
	5	80.4	26	74	85	30	0.028124		6.434782609		25	4.37E-03	4.37068E-05	2.40539E-05		
	6	80.2	26	74	85	30	0.028124		6.434782609		25	4.37E-03	4.37068E-05	2.40539E-05		
Δ10cm height	7	81.4	30	72	82	30	0.027132	0.027	6.260869565	6.261	26	4.33E-03	4.33354E-05	2.38496E-05	2.38496E-05	2.38E-03
	8	81.3	30	72	82	30	0.027132		6.260869565		26	4.33E-03	4.33354E-05	2.38496E-05		
	9	81.1	30	72	82	30	0.027132		6.260869565		26	4.33E-03	4.33354E-05	2.38496E-05		

MDD (g/cm3)	1.571
OMC	17.90

Area (cm2)=	100.74
Length between manometers (cm)=	11.50
Mass (perm.), g	2205.50

100% Compaction Height of Specimen (cm)	18.00
Final Height of Specimen (cm)	18.00
V (perm., cm3) at 18cm height	1813.37
Specimen Moisture Cntnt	17.30
Mass (wet) required for 6x 3cm compacted layers at 100% PRMDD	3341.65
Mass Final of Compacted Specimen	3346.80
Final Volume of Specimen (cm3)	1813.37
Dry Unit Weight	1.573
% Compaction	100.2

Void Ratio, e
Reltive Density, RD



Sample Identification		 FIRST QUANTUM MINERALS LTD.		Cobre Panamá
1	Informacion General (<i>Informacion General</i>)			
	Sample number (<i>Numero de muestra</i>):		MPSA-RT-DRI-026	
	sampled date (<i>Fecha de muestreo</i>):		7-Sep-21	
2	Material Information (<i>Informacion del Material</i>)			
	Source (<i>Fuente</i>)	Sand Cycloning Plant		
	Work Area (<i>Area de Trabajo</i>)	TMF NSD Sec.2 Sand Cell N°13/14 (inplace)		
	Borrow - Foundation - Excavation - Crusher - Fill - Site Investigation - Other: Plant <i>Prestamo - Fundacion - Excavacion - Crusher - Relleno - Investigacion de Sitio - Otro:</i>			
	Fill Zone (specs 1824-363-CI-SPC-0003): <i>Zona de Material:</i>			
	Material Type <i>Tipo de Material</i>		Cyclone Sand (Hydraulic)	Sieve Analysis for Double Ring Infiltrometer Test-DRI-026
	Remarks: <i>Comentarios:</i> Received: 12:00hrs, Complete Test: 21:00hrs			
	Hydraulically Placed and Compacted.			
		Start sta.:	End Sta.:	
	Coordinates - GPS or Survey (<i>Coordenadas - GPS o Topografia</i>):	N: 983183	E: 537019	
	Depth used to estimate elevation: (<i>Profundidad a la que se tomo la muestra</i>):	300mm		
	Recorded Ground elevation: (<i>Elevacion del terreno</i>)	El. 67.99m		
Technician:	Name: YG/EL		Signature:	
Lab Supervisor:	Name: CG		Signature:	

Form No. 1824-QC-LST-057 Rv02 Dual language

MINA COBRE PANAMA
Material Finer than 75mic. Sieve in Soil by Washing (ASTM D1140)



Sample Type:

Cyclone Sand (Hydraulic)

 Technician:

BG

Sample No:

MPSA-RT-DRI-026

 Date Tested:

7-Sep-21

Source:

Sand Cycloning Plant

 Date Sampled:

7-Sep-21

Location:

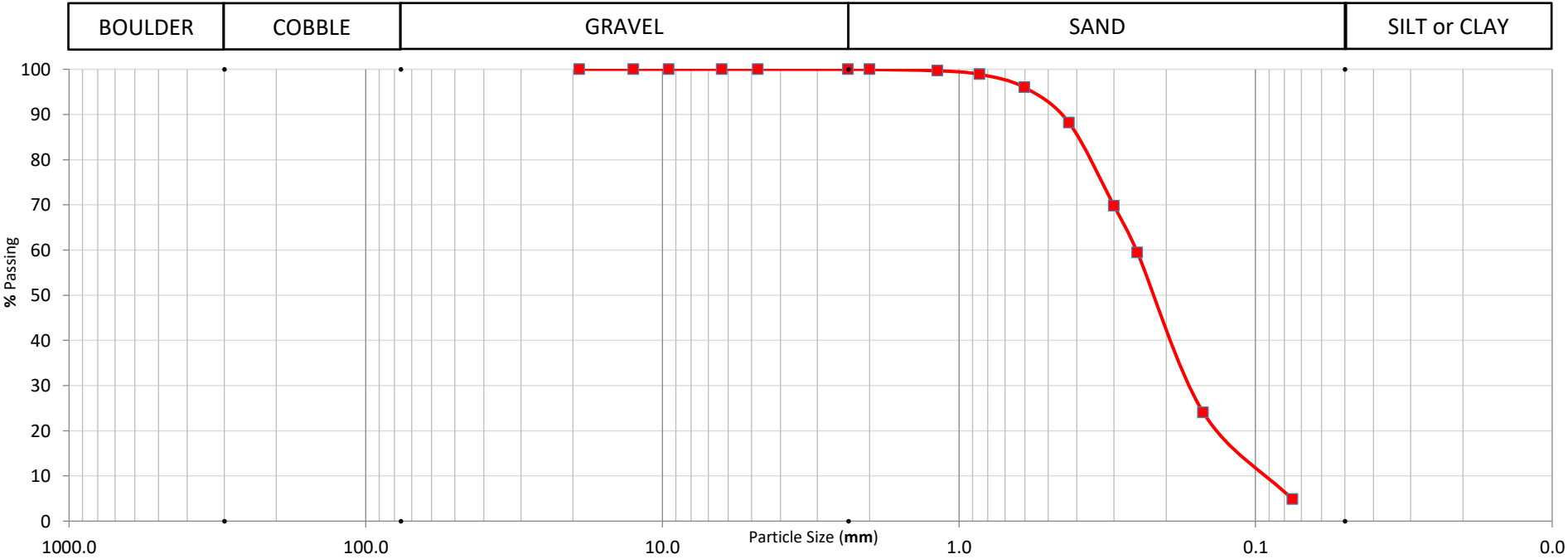
TMF NSD Sec.2 Sand Cell N°13/14 (inplace)

Other:

Sieve Analysis for Double Ring
Infiltrometer Test-DRI-026

Wet Weight (g):	1060.23
Moisture (%):	9.2
Orig. Dry Wt. (g):	971.17
Total Solid (%):	
Washed Oven Dry Wt. (g):	227.84
Washed Loss (g):	
Specific Gravity :	

Gravel	
Sand	95.2
Fines	4.8
Fineness Modulus	2.60



Sieve No	Sieve Size (mm)	Coarser Limit	Finer Limit	Ind. Ret. Wt. (g)	Cum. Ret. Wt. (g)	% Retained	% Passing
24"	600.0						
18"	450.0						
12"	300.0						
8"	200.0						
6"	150.0						
5"	125.0						
4"	100.0						
3"	75.0						
2 1/2"	63.0						
2"	50.0						
1.5"	37.5						
1"	25.0						
3/4"	19.0				0.00	0.0	100.0
1/2"	12.5				0.00	0.0	100.0
3/8"	9.5				0.00	0.0	100.0
1/4"	6.3				0.00	0.0	100.0

Sieve No	Sieve Size (mm)	Coarser Limit	Finer Limit	Ind. Ret. Wt. (g)	Cum. Ret. Wt. (g)	% Retained	% Passing
#4	4.75			0.00	0.00	0.0	100.0
#8	2.36			0.18	0.18	0.0	100.0
#10	2.00			0.24	0.42	0.0	100.0
#16	1.18			2.87	3.29	0.3	99.7
#20	0.85			7.74	11.03	1.1	98.9
#30	0.60			28.24	39.27	4.0	96.0
#40	0.425			76.17	115.44	11.9	88.1
#50	0.30			178.43	293.87	30.3	69.7
#60	0.25			100.51	394.38	40.6	59.4
#100	0.15			343.40	737.78	76.0	24.0
#200	0.075			186.78	924.56	95.2	4.8

Sample Identification		 Cobre Panamá	
1	Informacion General (Informacion General)		
	Sample number (Numero de muestra):	MPSA-SC-135	
	sampled date (Fecha de muestreo:)	7-Sep-21	
2	Material Information (Informacion del Material)		
	Source (Fuente)	Sand Cycloning Plant	
	Work Area (Area de Trabajo)	TMF NSD Sec.2 Sand Cell N°13/14 (In Place)	
	Borrow - Foundation - Excavation - Crusher - Fill - Site Investigation - Other: Prestamo - Fundacion - Excavacion - Crusher - Relleno - Investigacion de Sitio - Otro:		
	Fill Zone (specs 1824-363-CI-SPC-0003): Zona de Material:		
	Material Type Tipo de Material	Cyclone Sand	Density Test cone Method for DRI Test Sand-
	Remarks: Comentarios: Received: 12:00hrs		
	Using materials MPSA-RT-16891		
	Stations (along dam center line) Estaciones (Eje de Presa)	Start sta.:	End Sta.:
	Coordinates - GPS or Survey (Coordenadas - GPS o Topografia):	N: 983183	E: 537019
	Depth used to estimate elevation: (Profundidad a la que se tomo la muestra):	110mm	
	Recorded Ground elevation: (Elevacion del terreno)	El. 67.99m	
Technician:	Name: YG/EL	Signature:	
Lab Supervisor:	Name: CG	Signature:	

Form No. 1824-QC-LST-057 Rv02 Dual language

MINA COBRE PANAMA

Density and Unit Weight of Soil in Place by Sand-Cone Method
(ASTM D1556)



Sample Type: Cyclone Sand

Technician: YG

Location: TMF NSD Sec.2 Sand Cell N°13/14 (In Place)

Lab. No: MPSA-SC-135

Date Tested: 7-Sep-21

Source: Sand Cycloning Plant

Fill Material Ref. No.: MPSA- 12563

Date Sampled: 7-Sep-21

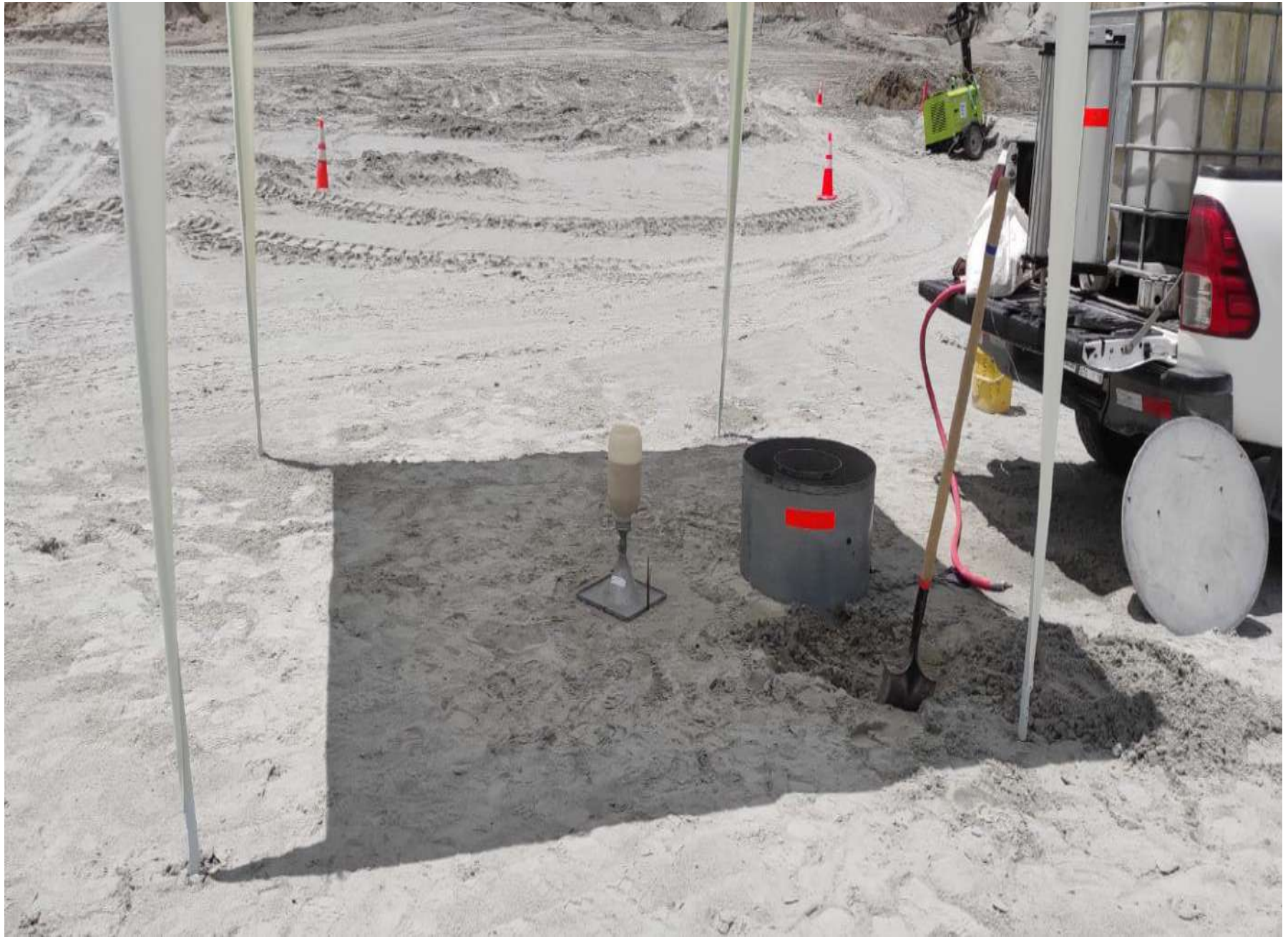
Density
Test
Sand-
cone
Method
for DRI
Test

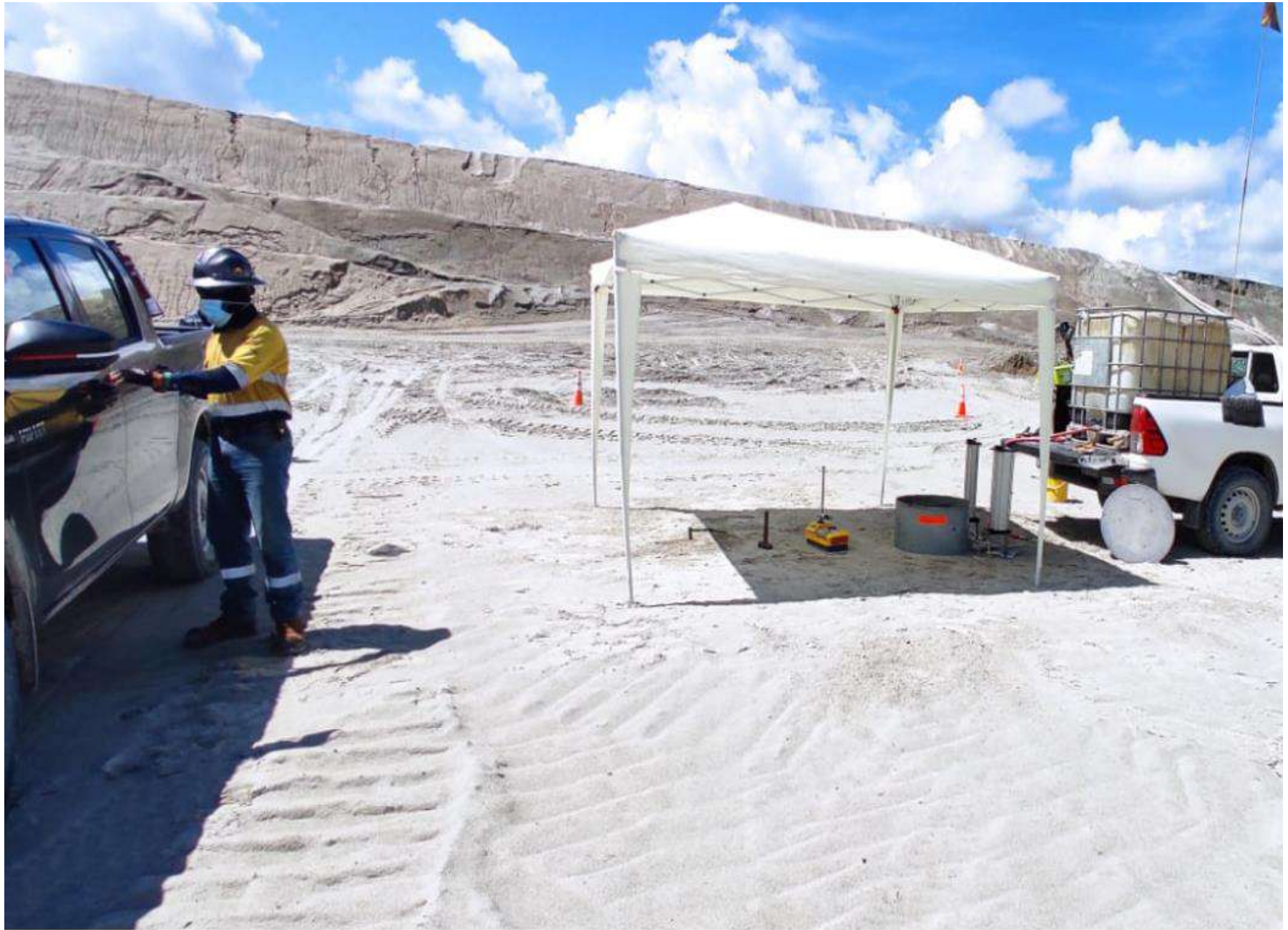
	110mm					
Coordinate (N, E)	983183 537019					
Elevation (m)	67.99m					
Test Hole Volume Determination						
Sand Cone Apparatus No.	1	1				
A. Mass of Sand in Container, Bef. Pouring (g)	7000					
B. Mass of Sand in Containerl, Aft. Pouring (g)	1982					
C. Mass of Sand in Funnel & Hole (g) (A-B)	5018					
D. Mass of Sand in Funnel (g) (frm Calib.)	1765					
E. Mass of Sand in Hole (g) (C-D)	3253					
F. Bulk Density of Sand (cm/g³) (frm Calib)	1.518					
G. Vol. of Test Hole (cm³) (E/F)	2143					
Water Content Determination (Laboratory)						
Method Used	D2216	☒	☐	☐	☐	☐
	D4643	☐	☐	☐	☐	☐
	D4959	☒	☒	☐	☐	☐
H. Mass of Container (g)	348					
I. Mass of Container+Moist Specimen (g)	1083					
J. Mass of Container+Dry Specimen (g)	1038					
K. Mass of Water (g) (I-J)	45					
L. Mass of Dry Specimen (g) (J-H)	690					
M. Water Content (%) (K/L)*100)	6.5					
Wet & Dry Density Determination (in-place)						
N. Moist Mass of Material from Hole (kg)	3676					
O. Dry Mass of Material from Hole (kg)	3295					
P. Wet Density of Tested Material (kg/m³) (N/G)	1.715					
Q. Dry Density of Tested Material (Kg/m³) (O/G)	1.538					
R. In-Situ Compaction (%) (Q/S)*100	101.4					
Laboratory Compaction						

S. Max. Dry Density (kg/m ³)	1.517					
T. Opt. Moist. Cont. (%)	20.4					









[illegible]







Date:	7-Sep-21	Location: TMF NSD Sec.2 Sand Cell N°13/14		N	983183
Sample ID:	MPSA-PERM-026			E	537019
Material:	Cyclone U/F Sand (Hydraulic Placement)			Elev.(m)	67.99m
Fines Content:	4.8%				
Source:	Sand Cycloning Plant				
Technician:	YG/DB	Date Tested	10-Sep-21		

Enter Data

SPECIFICATION: > 1.00E-04 cm/s

Viscosity Factor (v25/v20)= 0.5629348514

Viscosity Factor (v26/v20)= 0.5503478811

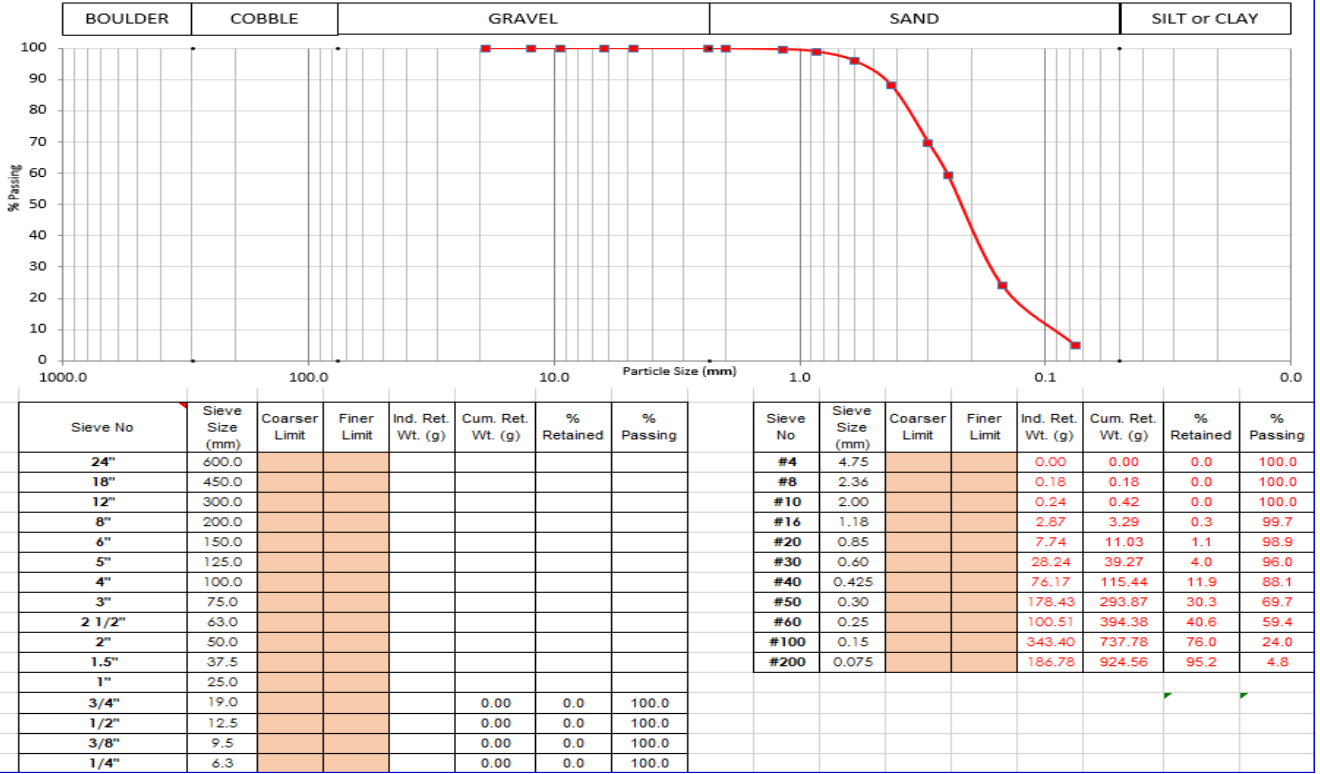
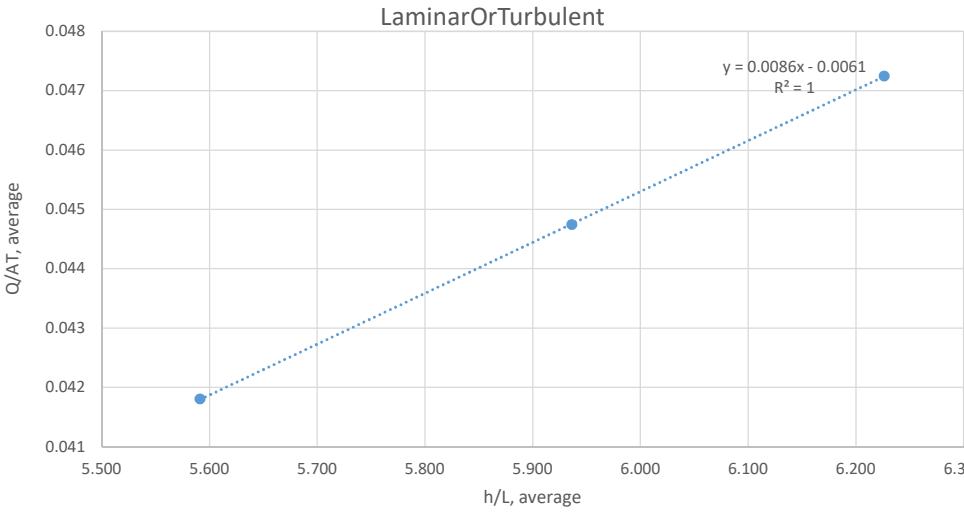
Flow Laminarity	Test	H1 (cm)	H2 (cm)	h (cm)	Q (cm3, mL)	t (s)	Q/At	Average Q/At	h/L	Average, h/L	T (°C)	k, cm/s	k, m/s	k, m/s, corrected	Average k, m/s, corrected	Average k, cm/s, corrected
0 height	1	94	22.5	71.5	145	30	0.047353	0.047	6.217391304	6.226	25	7.62E-03	7.61624E-05	4.28745E-05	4.23975E-05	4.2398E-03
	2	94	22.4	71.6	144	30	0.047027		6.226086957		25	7.55E-03	7.55315E-05	4.25193E-05		
	3	94	22.3	71.7	145	30	0.047353		6.234782609		26	7.59E-03	7.59499E-05	4.17989E-05		
Δ5cm height	4	94.3	26	68.3	137	30	0.044741	0.045	5.939130435	5.936	26	7.53E-03	7.53318E-05	4.14587E-05	4.14790E-05	4.1479E-03
	5	94.3	26	68.3	137	30	0.044741		5.939130435		26	7.53E-03	7.53318E-05	4.14587E-05		
	6	94.3	26.1	68.2	137	30	0.044741		5.930434783		26	7.54E-03	7.54423E-05	4.15195E-05		
Δ10cm height	7	95.2	30.9	64.3	128	30	0.041801	0.042	5.591304348	5.591	25	7.48E-03	7.47614E-05	4.20858E-05	4.14585E-05	4.1458E-03
	8	95.2	30.9	64.3	128	30	0.041801		5.591304348		26	7.48E-03	7.47614E-05	4.11448E-05		
	9	95.2	30.9	64.3	128	30	0.041801		5.591304348		26	7.48E-03	7.47614E-05	4.11448E-05		

MDD (g/cm3)	1.517
OMC	20.40

Area (cm2)= 102.07
Length between manometers (cm)= 11.50
Mass (perm.), g 2204.00

100% Compaction Height of Specimen (cm) 18.00
Final Height of Specimen (cm) 18.00
V (perm., cm3) at 18cm height 1837.26
Specimen Moisture Cntnt 20.30
Mass (wet) required for 6x 3cm compacted layers at 100% PRMDD 3352.91
Mass Final of Compacted Specimen 3360.90
Final Volume of Specimen (cm3) 1837.26
Dry Unit Weight 1.521
% Compaction 100.2

Void Ratio, e
Reltive Density, RD



Sample Identification		 FIRST QUANTUM MINERALS LTD. Cobre Panamá	
1	Informacion General (Informacion General)		
	Sample number (Numero de muestra):	MPSA-RT--DRI-027	
	sampled date (Fecha de muestreo):	17-Oct-21	
2	Material Information (Informacion del Material)		
	Source (Fuente)	Sand Cycloning Plant	
	Work Area (Area de Trabajo)	TMF NSD Sec.1 Cell-11 (inPlace)	
	Borrow - Foundation - Excavation - Crusher - Fill - Site Investigation - Other: Plant Prestamo - Fundacion - Excavacion - Crusher - Relleno - Investigacion de Sitio - Otro:		
	Fill Zone (specs 1824-363-CI-SPC-0003): Zona de Material:		
	Material Type Tipo de Material	Cyclone Sand (Hydraulic)	Sieve analysis Double Ring infiltrometer Test-DRI-027
	Remarks: Comentarios: received: 11:30 hrs, completed test: 18:34 hrs (17.10.2021)		
	Hydraulic Placed and Compacted		
		Start sta.:	End Sta.:
	Coordinates - GPS or Survey (Coordenadas - GPS o Topografia):	N: 983217	E: 537240
	Depth used to estimate elevation: (Profundidad a la que se tomo la muestra):	120 mm	
	Recorded Ground elevation: (Elevacion del terreno)	68.17 m	
Technician:	Name: EG / DB	Signature:	
Lab Supervisor:	Name: CG	Signature:	

MINA COBRE PANAMA
Gradation Analysis (ASTM D6913)



Cobre Panamá

Sample Type: Tailings Material

Technician: DS / BG

Location: TMF NSD Sec.1 Cell-11 (inPlace)

Sample No: MPSA-RT--DRI-027

Date Tested: 17-Oct-21

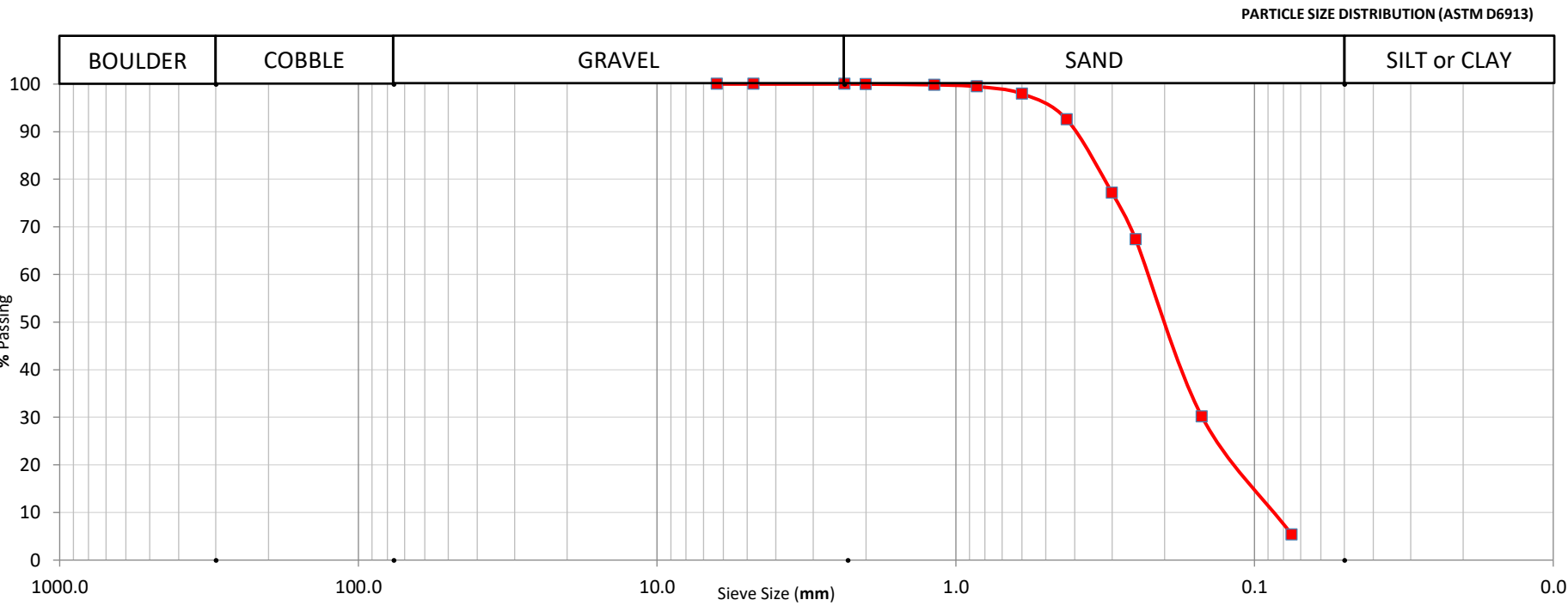
Other: Hydraulic Placed and Compacted

Source: Sand Cycloning Plant

Date Sampled: 17-Oct-21

Wet Weight (g):	626.30
Moisture (%):	6.2
Orig. Dry Wt. (g):	589.70
Total Solid (%):	
Washed Oven Dry Wt. (g):	558.23
Washed Loss (g):	31.47
Specific Gravity :	

Gravel	0.0
Sand	94.7
Fines	5.3
Fineness modulus	2.30



Sieve No	Sieve Size (mm)	Coarser Limit	Finer Limit	Ind. Ret. Wt. (g)	Cum. Ret. Wt. (g)	% Retained	% Passing
24"	600.0						
18"	450.0						
12"	300.0						
8"	200.0						
6"	150.0						
5"	125.0						
4"	100.0						
3"	75.0						
2 1/2"	63.0						
2"	50.0						
1.5"	37.5						
1"	25.0						
3/4"	19.0						
1/2"	12.5						
3/8"	9.5						
1/4"	6.3			0.00	0.00	0.0	100.0

Sieve No	Sieve Size (mm)	Coarser Limit	Finer Limit	Ind. Ret. Wt. (g)	Cum. Ret. Wt. (g)	% Retained	% Passing
#4	4.75			0.00	0.00	0.0	100.0
#8	2.36			0.00	0.00	0.0	100.0
#10	2.00			0.11	0.11	0.0	100.0
#16	1.18			0.86	0.97	0.2	99.8
#20	0.85			2.17	3.14	0.5	99.5
#30	0.60			8.88	12.02	2.0	98.0
#40	0.425			31.91	43.93	7.4	92.6
#50	0.30			90.79	134.72	22.8	77.2
#60	0.25			57.86	192.58	32.7	67.3
#100	0.15			219.44	412.02	69.9	30.1
#200	0.075			146.21	558.23	94.7	5.3

Sample Identification		 FIRST QUANTUM MINERALS LTD. Cobre Panamá	
1	Informacion General (<i>Informacion General</i>)		
	Sample number (<i>Numero de muestra</i>):	MPSA-SC-158	
	sampled date (<i>Fecha de muestreo</i>):	17-Oct-21	
2	Material Information (<i>Informacion del Material</i>)		
	Source (<i>Fuente</i>)	Sand Cyclone Plan	
	Work Area (<i>Area de Trabajo</i>)	TMF NSD Sec-1 Sand Cell N° 11 Plataforma Hidraulica (In Place)	
	Borrow - Foundation - Excavation - Crusher - Fill - Site Investigation - Other: <i>Prestamo - Fundacion - Excavacion - Crusher - Relleno - Investigacion de Sitio - Otro:</i>		
	Fill Zone (specs 1824-363-CI-SPC-0003): <i>Zona de Material:</i>		
	Material Type <i>Tipo de Material</i>	Cyclone Sand	Density Test cone Method for DRI Test Sand- Test
	Remarks: <i>Comentarios: Received: 11:30hrs</i>		
	Using materials MPSA-RT-18738		
	Stations (along dam center line) <i>Estaciones (Eje de Presa)</i>	Start sta.:	End Sta.:
	Coordinates - GPS or Survey <i>(Coordenadas - GPS o Topografia):</i>	N: 983217	E: 537240
	Depth used to estimate elevation: <i>(Profundidad a la que se tomo la muestra):</i>	120 mm	
	Recorded Ground elevation: <i>(Elevacion del terreno)</i>	68.17m	
Technician:	Name: EG / DB	Signature:	
Lab Supervisor:	Name: CG	Signature:	

Form No. 1824-QC-LST-057 Rv02 Dual language

MINA COBRE PANAMA

Density and Unit Weight of Soil in Place by Sand-Cone Method
(ASTM D1556)

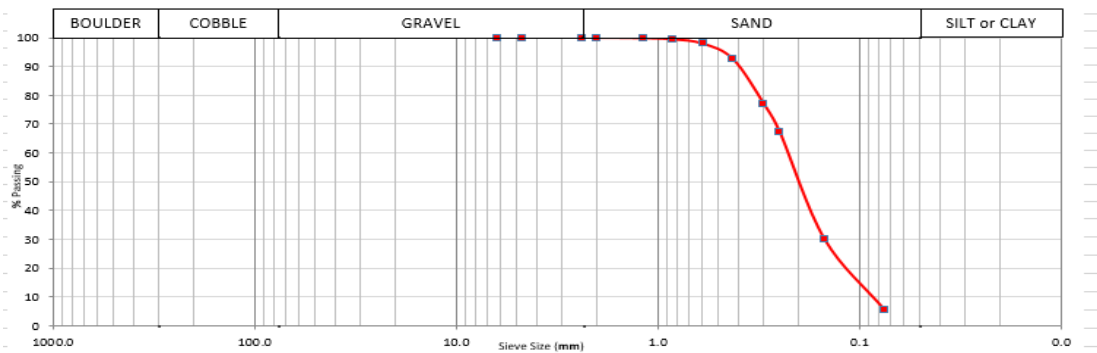


Sample Type:	Cyclone Sand	Technician:	EG / DB	Location:	TMF NSD Sec-1 Sand Cell N° 11 Plataforma Hidraulica (In Place)
Lab. No:	MPSA-SC-158	Date Tested:	17-Oct-21	Source:	Sand Cyclone Plan
Fill Material Ref. No.:	17897	Date Sampled:	17-Oct-21		

	120mm					
Coordinate (N, E)	983217 537240					
Elevation (m)	68.17 m					
Test Hole Volume Determination						
Sand Cone Apparatus No.	1	1				
A. Mass of Sand in Container, Bef. Pouring (g)	6605					
B. Mass of Sand in Containerl, Aft. Pouring (g)	905					
C. Mass of Sand in Funnel & Hole (g) (A-B)	5700					
D. Mass of Sand in Funnel (g) (frm Calib.)	1755					
E. Mass of Sand in Hole (g) (C-D)	3945					
F. Bulk Density of Sand (cm ³ /g) (frm Calib)	1.540					
G. Vol. of Test Hole (cm ³) (E/F)	2562					
Water Content Determination (Laboratory)						
Method Used	D2216	☒	☐	☐	☐	☐
	D4643	☐	☐	☐	☐	☐
	D4959	☒	☒	☐	☐	☐
H. Mass of Container (g)	646					
I. Mass of Container+Moist Specimen (g)	1053					
J. Mass of Container+Dry Specimen (g)	1036					
K. Mass of Water (g) (I-J)	17					
L. Mass of Dry Specimen (g) (J-H)	407					
M. Water Content (%) (K/L)*100)	4.2					
Wet & Dry Density Determination (in-place)						
N. Moist Mass of Material from Hole (kg)	4086					
O. Dry Mass of Material from Hole (kg)	3921					
P. Wet Density of Tested Material (kg/m ³) (N/G)	1.595					
Q. Dry Density of Tested Material (Kg/m ³) (O/G)	1.531					
R. In-Situ Compaction (%) (Q/S)*100	100.2					
Laboratory Compaction						
S. Max. Dry Density (kg/m ³)	1.528					
T. Opt. Moist. Cont. (%)	20.1					

[illegible]

Project Identification:				MPSA Cobre TMF				Constants		Area cm2		Depth of Liquid (cm)		Liquid Container Number		Marriotte Tube Volume		Marriotte Tube Area			
Test Location:				TMF NSD Sec.1 Sand Coll NP11 (N083217, ES37240 268.17m) Hydraulic Sand				Inner Ring		729		15.0				3000		54			
Liquid Used:				H ₂ O pH: N/A				Annular Space		2189		15.0				10000		167			
Tested By:				D. Barrios, / E. Gonzalez				Liquid level maintained using:		() Flow Valve () Float Valve (X) Mariotte Tubes											
Fines %:				6.3				Penetration Depth of Outer Ring: 15cm													
Trial #	Start / End	Date MM/DD/YY	Time HR:MIN	Elapsed Time Chg/(Total) Min	Flow Readings				Liquid Temp C	Infiltration Rate				Ground Temperature		Remarks					
					Inner Ring Reading cm	Inner Mariotte Tube Flow (ml)	Annular Space Reading cm	Annular Space Mariotte Tube Flow (ml)		Inner Infiltration Rate cm/h	Inner Infiltration Rate cm/s	Annular Infiltration Rate cm/h	Annular Infiltration Rate cm/s	Ground Temp Depth (cm)	Temp at Depth (c)		Weather Conditions Etc...				
1	Start Test	10/17/21	0:00:00		57.4		57.7	124	28.5	20.386	5.663E-03	11.931	3.314E-03	29.1	29.2	Annual Ring H ₂ O Depth Initial: 15cm Inner Ring H ₂ O Depth Initial: 15cm					
	End Test	10/17/21	0:00:30	0:00:30	55.1	56.4	28.5														
2	Start Test	10/17/21	0:00:30	0:00:30	51.5		55.5	194	28.5	31.909	8.863E-03	9.178	2.549E-03								
	End Test	10/17/21	0:01:00	0:01:00	47.9	54.5	28.5														
3	Start Test	10/17/21	0:01:00	0:00:30	44.4		53.6	151	28.5	24.818	6.894E-03	8.260	2.294E-03			Annual Ring H ₂ O Depth Final: 1.0cm Inner Ring H ₂ O Depth Final: 1.0cm					
	End Test	10/17/21	0:01:30	0:01:30	41.6	52.7	28.5														
4	Start Test	10/17/21	0:01:30	0:00:30	37.3		51.7	188	28.5	31.022	8.617E-03	8.260	2.294E-03								
	End Test	10/17/21	0:02:00	0:02:00	33.8	50.8	28.5														
5	Start Test	10/17/21	0:02:00	0:00:30	30.5		49.7	188	28.5	31.022	8.617E-03	10.095	2.804E-03			Weather conditions: Sunny Day, Hot weather					
	End Test	10/17/21	0:02:30	0:02:30	27.0	48.6	28.5														
6	Start Test	10/17/21	0:02:30	0:00:30	23.6		47.5	184	28.5	30.136	8.371E-03	10.095	2.804E-03			Weather Temp: 28.5°C					
	End Test	10/17/21	0:03:00	0:03:00	20.2	46.4	28.5														
7	Start Test	10/17/21	0:03:00	0:00:30	16.8		45.3	184	28.5	29.249	8.125E-03	10.095	2.804E-03								
	End Test	10/17/21	0:03:30	0:03:30	13.5	44.2	28.5														
8	Start Test	10/17/21	0:03:30	0:00:30	10.1		43.1	184	28.5	30.136	8.371E-03	10.095	2.804E-03			Nuclear Density Test					
	End Test	10/17/21	0:04:00	0:04:00	6.7	42.0	28.5														
9	Start Test	10/17/21	0:04:00	0:00:30	3.4		40.8	183	28.5	30.136	8.371E-03	11.013	3.059E-03			W.D: 1668. kg/m3					
	End Test	10/17/21	0:04:30	0:04:30	0.0	39.6	28.5														
10	Start Test															D.D: 1618 kg/m3					
11	End Test															M.C: 20.1%					
12	Start Test															Compaction: 105.9%					
13	End Test															(Using MPSA-RT-18738 Standard Lab. Compaction M.D.D: 1528 O.M.C: 20.1%) Hydraulic Sand					
14	Start Test																				
15	End Test																				
16	Start Test																				
17	End Test																				
18	Start Test																				
19	End Test																				
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32	Start Test																				
33	End Test																				
34	Start Test																				
35	End Test																				
36	Start Test																				
37	End Test																				
38	Start Test																				
39	End Test																				
40	Start Test																				
40	End Test																				



Sieve No.	Sieve Size (mm)	Coarse Limit	Fine Limit	Ret. Ret. %	Cum. Ret. %	% Passing	% Retained
24"	600.0						
18"	450.0						
12"	300.0						
8"	200.0						
6"	150.0						
5"	125.0						
4"	100.0						
3"	75.0						
2 1/2"	63.0						
2"	50.0						
1 1/2"	37.5						
1"	25.0						
3/4"	19.0						
1/2"	12.5						
3/8"	9.5						
1/4"	6.3			0.00	0.00	0.0	100.0

Sieve No.	Sieve Size (mm)	Coarse Limit	Fine Limit	Ret. Ret. %	Cum. Ret. %	% Passing	% Retained
#4	4.75			0.00	0.00	0.0	100.0
#8	2.36			0.00	0.00	0.0	100.0
#10	2.00			0.00	0.00	0.0	100.0
#16	1.18			0.00	0.00	0.2	99.8
#20	0.85			0.00	0.00	0.5	99.5
#30	0.60			0.00	0.00	2.0	98.0
#40	0.425			0.00	0.00	7.4	92.6
#50	0.30			0.00	0.00	22.8	77.2
#60	0.25			0.00	0.00	32.7	67.3
#100	0.15			0.00	0.00	69.9	30.1
#200	0.075			0.00	0.00	94.7	5.3





Date:	17-Oct-21	Location: TMF NSD Sec.1 Sand Cell N#11		N	983217
Sample ID:	MPSA-PERM-027			E	537240
Material:	Cyclone U/F Sand (Hydraulic Placement)			Elev.(m)	68.17m
Fines Content:	5.2%				
Source:	Sand Cycloning Plant				
Technician:	EG/DB	Date Tested	17-Oct-21		

Enter Data

SPECIFICATION: > 1.00E-04 cm/s

Viscosity Factor (v26/v20)= 0.5629348514

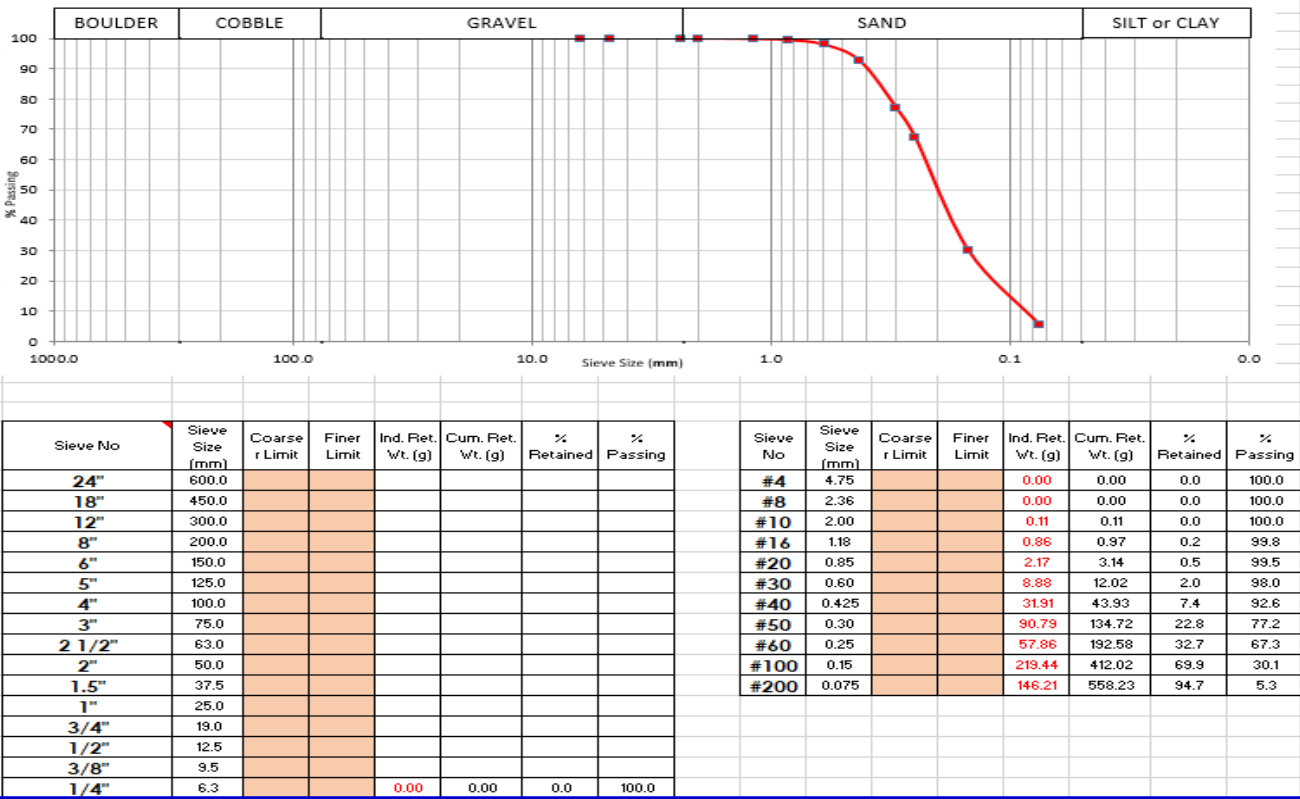
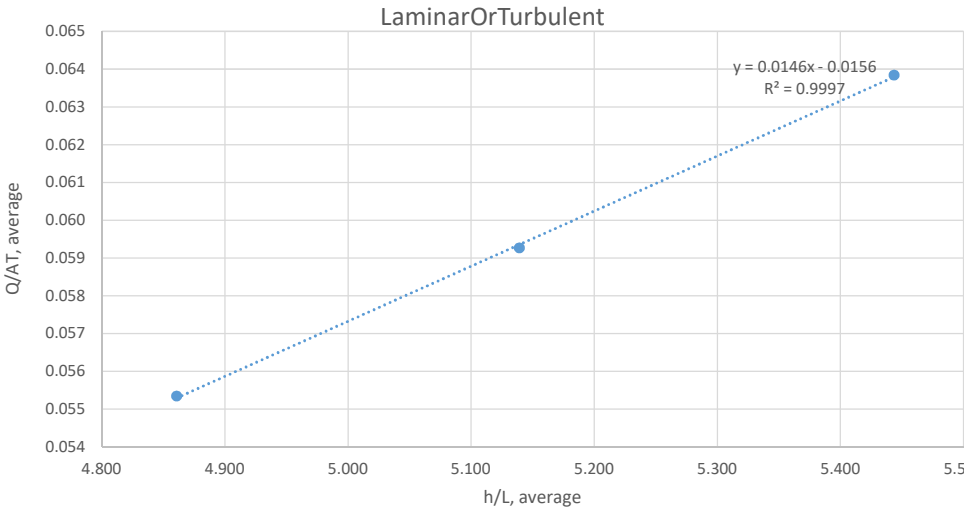
Viscosity Factor (v27/v20)= 0.5382036686

Flow Laminarity	Test	H1 (cm)	H2 (cm)	h (cm)	Q (cm3, mL)	t (s)	Q/At	Average Q/At	h/L	Average, h/L	T (°C)	k, cm/s	k, m/s	k, m/s, corrected	Average k, m/s, corrected	Average k, cm/s, corrected
0 height	1	87.4	24.7	62.7	195	30	0.063725	0.064	5.452173913	5.443	26	1.17E-02	1.16881E-04	6.57963E-05	6.40776E-05	6.4078E-03
	2	87.3	24.8	62.5	195	30	0.063725		5.434782609		27	1.17E-02	0.000117255	6.31070E-05		
	3	87.3	24.7	62.6	196	30	0.064052		5.443478261		27	1.18E-02	0.000117668	6.33293E-05		
Δ5cm height	4	88.4	29.3	59.1	182	30	0.059477	0.059	5.139130435	5.139	27	1.16E-02	0.000115734	6.22884E-05	6.20602E-05	6.2060E-03
	5	88.4	29.3	59.1	181	30	0.05915		5.139130435		27	1.15E-02	0.000115098	6.19461E-05		
	6	88.3	29.2	59.1	181	30	0.05915		5.139130435		27	1.15E-02	0.000115098	6.19461E-05		
Δ10cm height	7	89.7	33.8	55.9	169	30	0.055229	0.055	4.860869565	4.861	26	1.14E-02	0.000113619	6.39601E-05	6.40863E-05	6.4086E-03
	8	89.7	33.8	55.9	169	30	0.055229		4.860869565		26	1.14E-02	0.000113619	6.39601E-05		
	9	89.6	33.7	55.9	170	30	0.055556		4.860869565		26	1.14E-02	0.000114291	6.43386E-05		

MDD (g/cm3)	1.528
OMC	20.10

Area (cm2)=	102.00
Length between manometers (cm)=	11.50
Mass (perm.), g	2204.00
100% Compaction Height of Specimen (cm)	18.00
Final Height of Specimen (cm)	18.00
V (perm., cm3) at 18cm height	1836.00
Specimen Moisture Cntnt	20.10
Mass (wet) required for 6x 3cm compacted layers at 100% PRMDD	3369.30
Mass Final of Compacted Specimen	3366.30
Final Volume of Specimen (cm3)	1836.00
Dry Unit Weight	1.527
% Compaction	99.9

Void Ratio, e
Reltive Density, RD



Project Identification:		MPSA Cobre TMF					Constants		Area cm2		Depth of Liquid (cm)		Liquid Container Number		Marriotte Tube Volume		Marriotte Tube Area	
Test Location:		TMF NSD Sec.3 Sand Cell Nº22 (N983038, E536245 Z66.60m) Hydraulic Sand					Inner Ring		729		15.0				3000		54	
Liquid Used:		H ₂ O		pH: N/A		Annular Space		2189		15.0				10000		167		
Tested By:		J.Cumbrera / A.Molina					Liquid level maintained using: () Flow Valve () Float Valve (X) Mariotte Tubes											
Fines %:		7.0					Penetration Depth of Outer Ring: 15cm											
						Flow Readings					Infiltration Rate				Ground Temperature		Remarks	
Trial #	Start / End	Date MM/DD/YY	Time HR:MIN	Elapsed Time Chg/(Total) Min		Inner Ring Reading cm	Inner Mariotte Tube Flow (ml)	Annular Space Reading cm	Annular Space Mariotte Tube Flow (ml)	Liquid Temp C	Inner Infiltration Rate cm/h	Inner Infiltration Rate cm/s	Annular Infiltration Rate cm/h	Annular Infiltration Rate cm/s	Ground Temp Depth (cm)	Temp at Depth (c)	Weather Conditions Etc...	
1	Start Test	10/26/21	0:00:00			58.0		57.0		28.0							Annual Ring H ₂ O Depth Initial: 15cm	
	End Test	10/26/21	0:00:30	0:00:30		52.9	275	56.9	17	28.0	45.204	1.256E-02	0.918	2.549E-04	29.5	28.5	Inner Ring H ₂ O Depth Initial: 15cm	
2	Start Test	10/26/21	0:00:30	0:00:30		52.9		56.9		28.0								
	End Test	10/26/21	0:01:00	0:01:00		51.3	86	56.5	67	28.0	14.182	3.939E-03	3.671	1.020E-03				
3	Start Test	10/26/21	0:01:00	0:00:30		51.3		56.5		28.0							Annual Ring H ₂ O Depth Final: 6.0cm	
	End Test	10/26/21	0:01:30	0:01:30		49.5	97	55.9	100	28.0	15.954	4.432E-03	5.507	1.530E-03			Inner Ring H ₂ O Depth Final: 3.0cm	
4	Start Test	10/26/21	0:01:30	0:00:30		49.5		55.9		28.0								
	End Test	10/26/21	0:02:00	0:02:00		47.6	102	55.5	67	28.0	16.841	4.678E-03	3.671	1.020E-03				
5	Start Test	10/26/21	0:02:00	0:00:30		47.6		55.5		28.0								
	End Test	10/26/21	0:02:30	0:02:30		45.9	92	55.0	84	28.0	15.068	4.186E-03	4.589	1.275E-03			Weather conditions: Sunny Day, Hot weather	
6	Start Test	10/26/21	0:02:30	0:00:30		45.9		55.0		28.0								
	End Test	10/26/21	0:03:00	0:03:00		44.3	86	54.5	84	28.0	14.182	3.939E-03	4.589	1.275E-03			Weather Temp: 28.0°C	
7	Start Test	10/26/21	0:03:00	0:00:30		44.3		54.5		28.0								
	End Test	10/26/21	0:03:30	0:03:30		42.8	81	54.1	67	28.0	13.295	3.693E-03	3.671	1.020E-03				
8	Start Test	10/26/21	0:03:30	0:00:30		42.8		54.1		28.0							Nuclear Density Test	
	End Test	10/26/21	0:04:00	0:04:00		41.5	70	53.6	84	28.0	11.523	3.201E-03	4.589	1.275E-03				
9	Start Test	10/26/21	0:04:00	0:00:30		41.5		53.6		28.0							W.D: 1854kg/m3	
	End Test	10/26/21	0:04:30	0:04:30		40.2	70	53.1	84	28.0	11.523	3.201E-03	4.589	1.275E-03				
10	Start Test	10/26/21	0:04:30	0:00:30		40.2		53.1		28.0							D.D: 1661kg/m3	
	End Test	10/26/21	0:05:00	0:05:00		38.9	70	52.6	84	28.0	11.523	3.201E-03	4.589	1.275E-03				
11	Start Test	10/26/21	0:05:00	0:00:30		38.9		52.6		28.0							M.C: 11.6%	
	End Test	10/26/21	0:05:30	0:05:30		37.9	54	51.5	184	28.0	8.863	2.462E-03	10.095	2.804E-03				
12	Start Test	10/26/21	0:05:30	0:00:30		37.9		51.5		28.0							Compaction: 108.1%	
	End Test	10/26/21	0:06:00	0:06:00		36.7	65	50.6	151	28.0	10.636	2.954E-03	8.260	2.294E-03				
13	Start Test	10/26/21	0:06:00	0:00:30		36.7		50.6		28.0							(Using MPSA-RT-19018 Standard Lab. Compaction M.D.D: 1537 O.M.C: 18.3%) Hydraulic Sand	
	End Test	10/26/21	0:06:30	0:06:30		35.6	59	49.9	117	28.0	9.750	2.708E-03	6.424	1.785E-03				
14	Start Test	10/26/21	0:06:30	0:00:30		35.6		49.9		28.0								
	End Test	10/26/21	0:07:00	0:07:00		34.6	54	49.2	117	28.0	8.863	2.462E-03	6.424	1.785E-03				
15	Start Test	10/26/21	0:07:00	0:00:30		34.6		49.2		28.0								
	End Test	10/26/21	0:07:30	0:07:30		33.6	54	48.4	134	28.0	8.863	2.462E-03	7.342	2.039E-03				
16	Start Test	10/26/21	0:07:30	0:00:30		33.6		48.4		28.0								
	End Test	10/26/21	0:08:00	0:08:00		32.7	48	47.6	134	28.0	7.977	2.216E-03	7.342	2.039E-03				
17	Start Test	10/26/21	0:08:00	0:00:30		32.7		47.6		28.0								
	End Test	10/26/21	0:08:30	0:08:30		31.8	48	46.8	134	28.0	7.977	2.216E-03	7.342	2.039E-03				
18	Start Test	10/26/21	0:08:30	0:00:30		31.8		46.8		28.0								
	End Test	10/26/21	0:09:00	0:09:00		30.7	59	46.1	117	28.0	9.750	2.708E-03	6.424	1.785E-03				
19	Start Test	10/26/21	0:09:00	0:00:30		30.7		46.1		28.0								
	End Test	10/26/21	0:09:30	0:09:30		29.9	43	45.4	117	28.0	7.091	1.970E-03	6.424	1.785E-03				
20	Start Test	10/26/21	0:09:30	0:00:30		29.9		45.4		28.0								
	End Test	10/26/21	0:10:00	0:10:00		28.9	54	44.5	151	28.0	8.863	2.462E-03	8.260	2.294E-03				
21	Start Test	10/26/21	0:10:00	0:00:30		28.9		44.5		28.0								
	End Test	10/26/21	0:10:30	0:10:30		27.9	54	43.7	134	28.0	8.863	2.462E-03	7.342	2.039E-03				
22	Start Test	10/26/21	0:10:30	0:00:30		27.9		43.7		28.0								
	End Test	10/26/21	0:11:00	0:11:00		27.1	43	42.8	151	28.0	7.091	1.970E-03	8.260	2.294E-03				
23	Start Test	10/26/21	0:11:00	0:00:30		27.1		42.8		28.0								
	End Test	10/26/21	0:11:30	0:11:30		26.4	38	42.2	100	28.0	6.204	1.723E-03	5.507	1.530E-03				
24	Start Test	10/26/21	0:11:30	0:00:30		26.4		42.2		28.0								
	End Test	10/26/21	0:12:00	0:12:00		25.5	48	41.4	134	28.0	7.977	2.216E-03	7.342	2.039E-03				
25	Start Test	10/26/21	0:12:00	0:00:30		25.5		41.4		28.0								
	End Test	10/26/21	0:12:30	0:12:30		24.5	54	40.5	151	28.0	8.863	2.462E-03	8.260	2.294E-03				
26	Start Test	10/26/21	0:12:30	0:00:30		24.5		40.5		28.0								
	End Test	10/26/21	0:13:00	0:13:00		23.6	48	39.7	134	28.0	7.977	2.216E-03	7.342	2.039E-03				
27	Start Test	10/26/21	0:13:00	0:00:30		23.6		39.7		28.0								
	End Test	10/26/21	0:13:30	0:13:30		22.7	48	38.8	151	28.0	7.977	2.216E-03	8.260	2.294E-03				
28	Start Test	10/26/21	0:13:30	0:00:30		22.7		38.8		28.0								
	End Test	10/26/21	0:14:00	0:14:00		21.9	43	38.0	134	28.0	7.091	1.970E-03	7.342	2.039E-03				
29	Start Test	10/26/21	0:14:00	0:00:30		21.9		38.0		28.0								
	End Test	10/26/21	0:14:30	0:14:30		21.0	48	37.3	117	28.0	7.977	2.216E-03	6.424	1.785E-03				
30	Start Test	10/26/21	0:14:30	0:00:30		21.0		37.3		28.0								
	End Test	10/26/21	0:15:00	0:15:00		20.0	54	36.2	184	28.0	8.863	2.462E-03	10.095	2.804E-03				
31	Start Test	10/26/21	0:15:00	0:00:30		20.0		36.2		28.0								
	End Test	10/26/21	0:15:30	0:15:30		19.3	38	35.5	117	28.0	6.204	1.723E-03	6.424	1.785E-03				
32	Start Test	10/26/21	0:15:30	0:00:30		19.3		35.5		28.0								
	End Test	10/26/21	0:16:00	0:16:00		18.5	43	34.7	134	28.0	7.091	1.970E-03	7.342	2.039E-03				
33	Start Test	11/23/20	0:16:00	0:00:30		18.5		34.7		28.0								
	End Test	11/23/20	0:16:30	0:16:30		17.6	48	33.9	134	28.0	7.977	2.216E-03	7.342	2.039E-03				
34	Start Test	11/23/20	0:16:30	0:00:30		17.6		33.9		28.0								
	End Test	11/23/20	0:17:00	0:17:00		16.7	48	33.1	134	28.0	7.977	2.216E-03	7.342	2.039E-03				
35	Start Test	11/23/20	0:17:00	0:00:30		16.7		33.1		28.0								
	End Test	11/23/20	0:17:30	0:17:30		15.9	43	32.2	151	28.0	7.091	1.970E-03	8.260	2.294E-03				
36	Start Test	11/23/20	0:17:30	0:00:30		15.9		32.2		28.0								
	End Test	11/23/20	0:18:00</															

MINA COBRE PANAMA
Material Finer than 75mic. Sieve in Soil by Washing (ASTM D1140)



Sample Type:

Cyclone Sand (Hydraulic)

 Technician:

JS/AM

Sample No:

MPSA-RT-DRI-028

 Date Tested:

26-Oct-21

Source:

Sand Cycloning Plant

 Date Sampled:

26-Oct-21

Location:

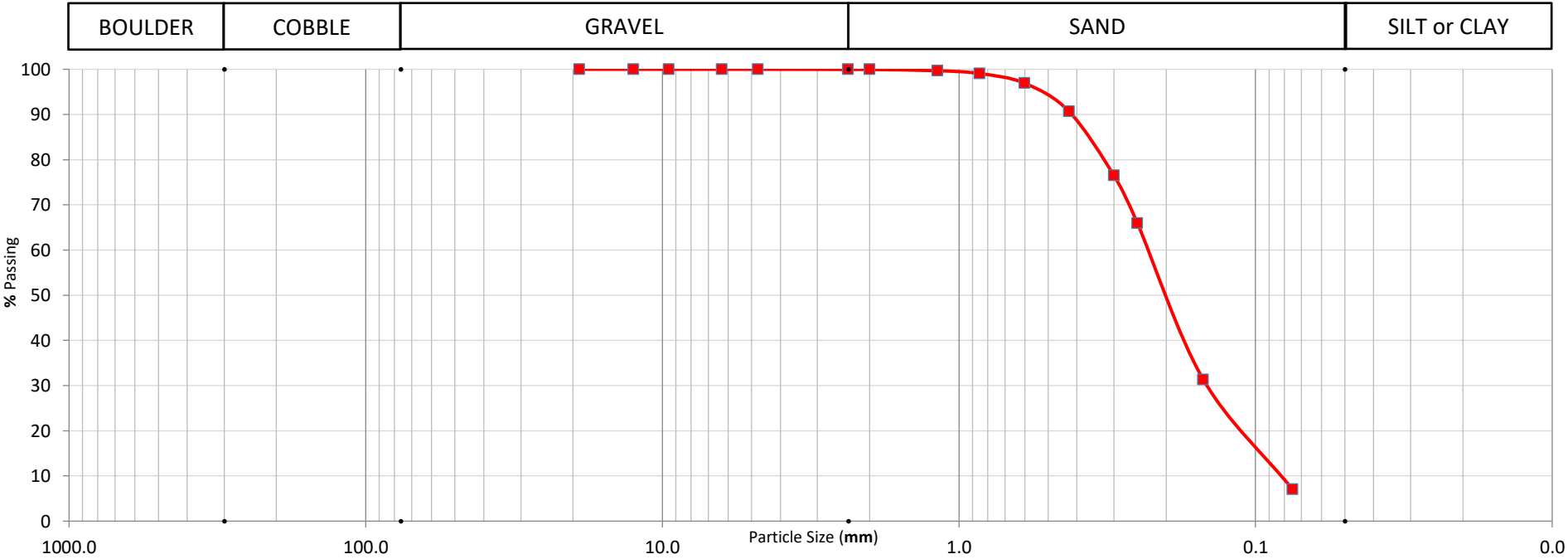
TMF NSD Sec.3 Sand Cell N°22 (inplace)

Other:

Sieve Analysis for Double Ring
Infiltrometer Test-DRI-026

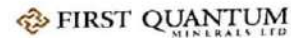
Wet Weight (g):	642.72
Moisture (%):	11.5
Orig. Dry Wt. (g):	576.66
Total Solid (%):	
Washed Oven Dry Wt. (g):	227.84
Washed Loss (g):	
Specific Gravity :	

Gravel	
Sand	93.0
Fines	7.0
Fineness Modulus	2.33



Sieve No	Sieve Size (mm)	Coarser Limit	Finer Limit	Ind. Ret. Wt. (g)	Cum. Ret. Wt. (g)	% Retained	% Passing
24"	600.0						
18"	450.0						
12"	300.0						
8"	200.0						
6"	150.0						
5"	125.0						
4"	100.0						
3"	75.0						
2 1/2"	63.0						
2"	50.0						
1.5"	37.5						
1"	25.0						
3/4"	19.0				0.00	0.0	100.0
1/2"	12.5				0.00	0.0	100.0
3/8"	9.5				0.00	0.0	100.0
1/4"	6.3				0.00	0.0	100.0

Sieve No	Sieve Size (mm)	Coarser Limit	Finer Limit	Ind. Ret. Wt. (g)	Cum. Ret. Wt. (g)	% Retained	% Passing
#4	4.75			0.00	0.00	0.0	100.0
#8	2.36			0.24	0.24	0.0	100.0
#10	2.00			0.02	0.26	0.0	100.0
#16	1.18			1.60	1.86	0.3	99.7
#20	0.85			3.60	5.46	0.9	99.1
#30	0.60			12.39	17.85	3.1	96.9
#40	0.425			36.10	53.95	9.4	90.6
#50	0.30			81.86	135.81	23.6	76.4
#60	0.25			60.91	196.72	34.1	65.9
#100	0.15			199.32	396.04	68.7	31.3
#200	0.075			140.03	536.07	93.0	7.0

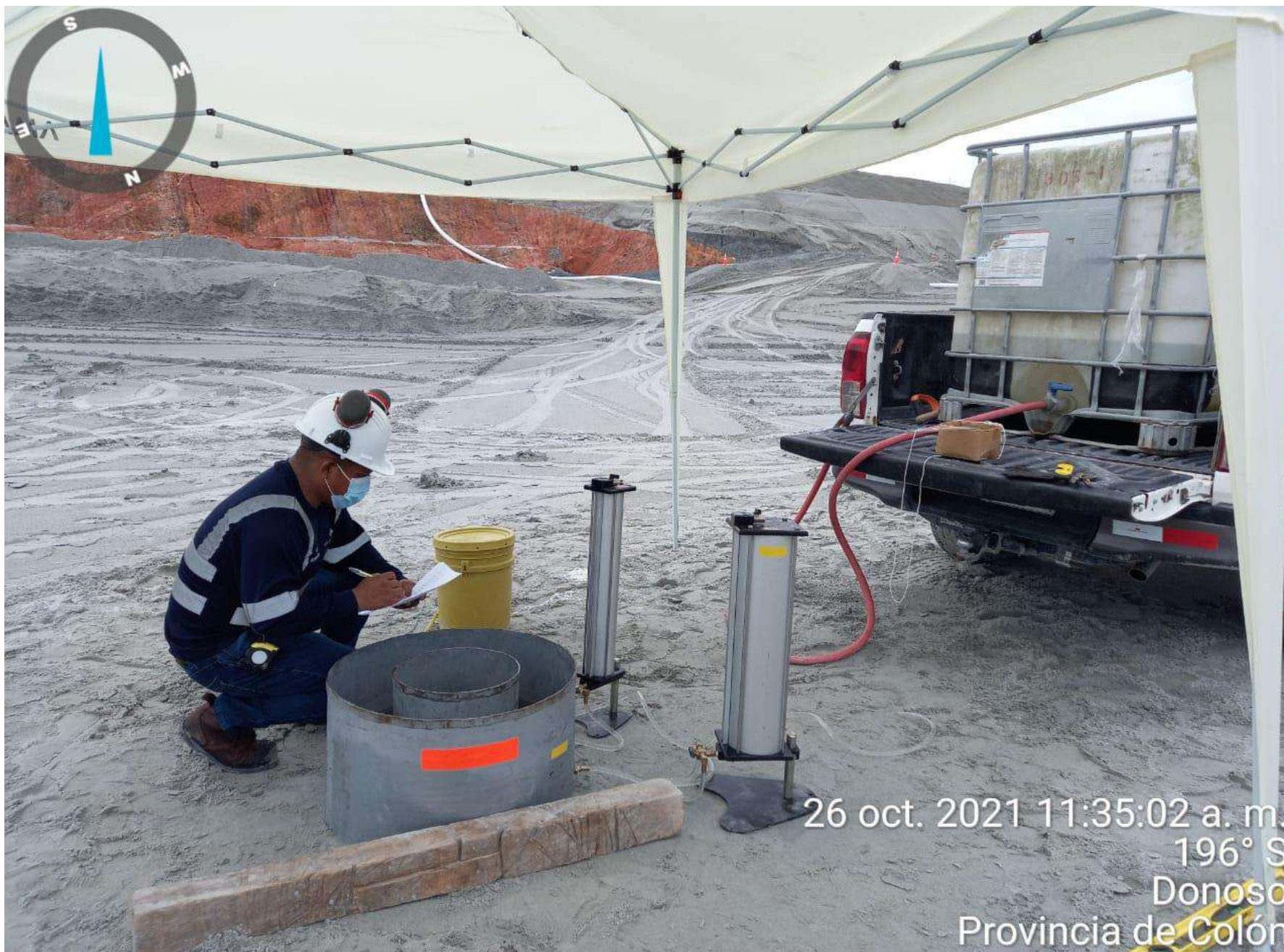
Materia Panamá

Cobre Panamá

[illegible]



26 oct. 2021 9:17:24 a. m.
254° W
Donoso
Provincia de Colón



26 oct. 2021 11:35:02 a. m.
196° S
Donoso
Provincia de Colón



Date:	26-Oct-21	Location: TMF NSD Sec.1 Sand Cell N#11		N	983038
Sample ID:	MPSA-PERM-028			E	536245
Material:	Cyclone U/F Sand (Hydraulic Placement)			Elev.(m)	66.60m
Fines Content:	7.0%				
Source:	Sand Cycloning Plant				
Technician:	MG/DB	Date Tested	28-Oct-21		

Enter Data

SPECIFICATION: > 1.00E-04 cm/s

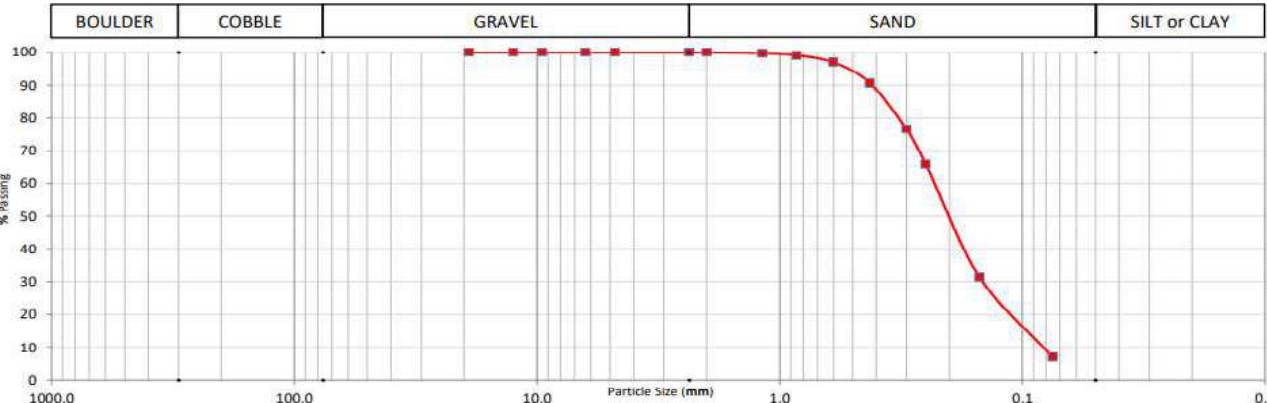
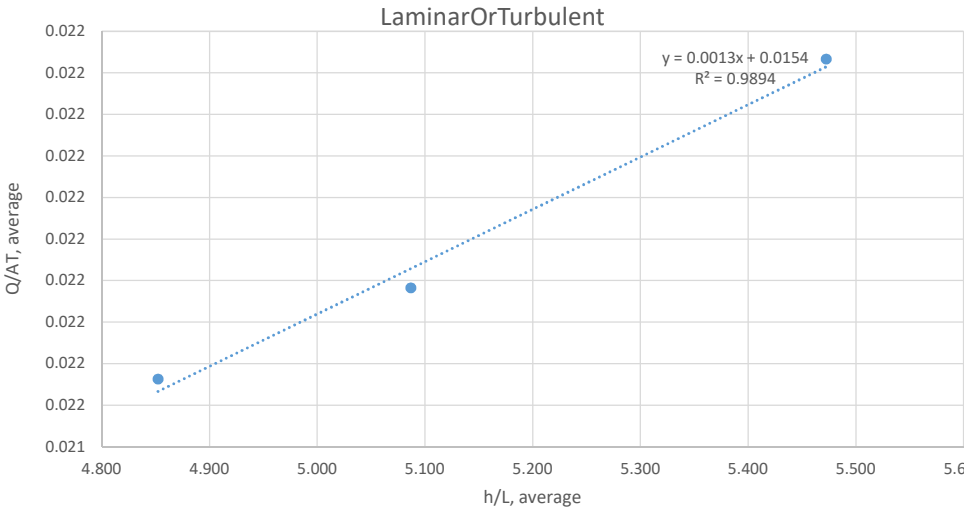
Viscosity Factor (v22/v20)=	0.6036685642
Viscosity Factor (v23/v20)=	0.5895635674
Viscosity Factor (v25/v20)=	0.5629348514

Flow Laminarity	Test	H1 (cm)	H2 (cm)	h (cm)	Q (cm3, mL)	t (s)	Q/At	Average Q/At	h/L	Average, h/L	T (°C)	k, cm/s	k, m/s	k, m/s, corrected	Average k, m/s, corrected	Average k, cm/s, corrected
0 height	1	92.5	29.5	63	67	30	0.022112	0.022	5.47826087	5.472	22	4.04E-03	4.03636E-05	2.43662E-05	2.46349E-05	2.4635E-03
	2	92.5	29.5	63	68	30	0.022442		5.47826087		22	4.10E-03	4.0966E-05	2.47299E-05		
	3	92.4	29.6	62.8	68	30	0.022442		5.460869565		22	4.11E-03	4.10965E-05	2.48086E-05		
Δ5cm height	4	92.9	34.4	58.5	66	30	0.021782	0.022	5.086956522	5.087	23	4.28E-03	4.28197E-05	2.52449E-05	2.52449E-05	2.5245E-03
	5	92.8	34.3	58.5	66	30	0.021782		5.086956522		23	4.28E-03	4.28197E-05	2.52449E-05		
	6	92.8	34.3	58.5	66	30	0.021782		5.086956522		23	4.28E-03	4.28197E-05	2.52449E-05		
Δ10cm height	7	93.2	37.4	55.8	65	30	0.021452	0.022	4.852173913	4.852	25	4.42E-03	4.42114E-05	2.48881E-05	2.50158E-05	2.5016E-03
	8	93.2	37.4	55.8	65	30	0.021452		4.852173913		25	4.42E-03	4.42114E-05	2.48881E-05		
	9	93.2	37.4	55.8	66	30	0.021782		4.852173913		26	4.49E-03	4.48916E-05	2.5271E-05		

MDD (g/cm3)	1.537
OMC	18.30

Area (cm2)=	101.00
Length between manometers (cm)=	11.50
Mass (perm.), g	2204.00
100% Compaction Height of Specimen (cm)	18.00
Final Height of Specimen (cm)	18.00
V (perm., cm3) at 18cm height	1818.00
Specimen Moisture Cntnt	18.10
Mass (wet) required for 6x 3cm compacted layers at 100% PRMDD	3300.03
Mass Final of Compacted Specimen	3325.70
Final Volume of Specimen (cm3)	1818.00
Dry Unit Weight	1.549
% Compaction	100.8

Void Ratio, e
Reltive Density, RD



Sieve No	Sieve Size (mm)	Coarser Limit	Finer Limit	Ind. Ret. Wt. (g)	Cum. Ret. Wt. (g)	% Retained	% Passing
24"	600.0						
18"	450.0						
12"	300.0						
8"	200.0						
6"	150.0						
5"	125.0						
4"	100.0						
3"	75.0						
2 1/2"	63.0						
2"	50.0						
1.5"	37.5						
1"	25.0						
3/4"	19.0				0.00	0.0	100.0
1/2"	12.5				0.00	0.0	100.0
3/8"	9.5				0.00	0.0	100.0
1/4"	6.3				0.00	0.0	100.0

Sieve No	Sieve Size (mm)	Coarser Limit	Finer Limit	Ind. Ret. Wt. (g)	Cum. Ret. Wt. (g)	% Retained	% Passing
#4	4.75			0.00	0.00	0.0	100.0
#8	2.36			0.24	0.24	0.0	100.0
#10	2.00			0.02	0.26	0.0	100.0
#16	1.18			1.60	1.86	0.3	99.7
#20	0.85			3.60	5.46	0.9	99.1
#30	0.60			12.39	17.85	3.1	96.9
#40	0.425			36.10	53.95	9.4	90.6
#50	0.30			81.86	135.81	23.6	76.4
#60	0.25			60.91	196.72	34.1	65.9
#100	0.15			199.32	396.04	68.7	31.3
#200	0.075			140.03	536.07	93.0	7.0

Sample Identification		 FIRST QUANTUM MINERALS LTD. Cobre Panamá	
1	Informacion General (<i>Informacion General</i>)		
	Sample number (<i>Numero de muestra</i>):	MPSA-RT-DRI-029	
	sampled date (<i>Fecha de muestreo</i>):	6-Nov-21	
2	Material Information (<i>Informacion del Material</i>)		
	Source (<i>Fuente</i>)	Sand Cycloning Plant	
	Work Area (<i>Area de Trabajo</i>)	TMF NSD Sec.1 Sand Cell N°11 (inplace)	
	Borrow - Foundation - Excavation - Crusher - Fill - Site Investigation - Other: Plant <i>Prestamo - Fundacion - Excavacion - Crusher - Relleno - Investigacion de Sitio - Otro:</i>		
	Fill Zone (specs 1824-363-CI-SPC-0003): <i>Zona de Material:</i>		
	Material Type <i>Tipo de Material</i>	Cyclone Sand (Hydraulic)	Sieve Analysis for Double Ring Infiltrometer Test-DRI-029
	Remarks: <i>Comentarios:</i> Received: 17:40hrs, Complete Test: 20:25hrs		
	Hydraulically Placed and Compacted.		
		Start sta.:	End Sta.:
	Coordinates - GPS or Survey (<i>Coordenadas - GPS o Topografia</i>):	N: 983199	E: 537282
	Depth used to estimate elevation: (<i>Profundidad a la que se tomo la muestra</i>):	300mm	
	Recorded Ground elevation: (<i>Elevacion del terreno</i>)	El. 71.46m	
Technician:	Name: YG/AP	Signature:	
Lab Supervisor:	Name: CG	Signature:	

MINA COBRE PANAMA
Material Finer than 75mic. Sieve in Soil by Washing (ASTM D1140)



Sample Type: Cyclone Sand (Hydraulic) Technician: AP/YG

Sample No: MPSA-RT-DRI-029 Date Tested: 6-Nov-21

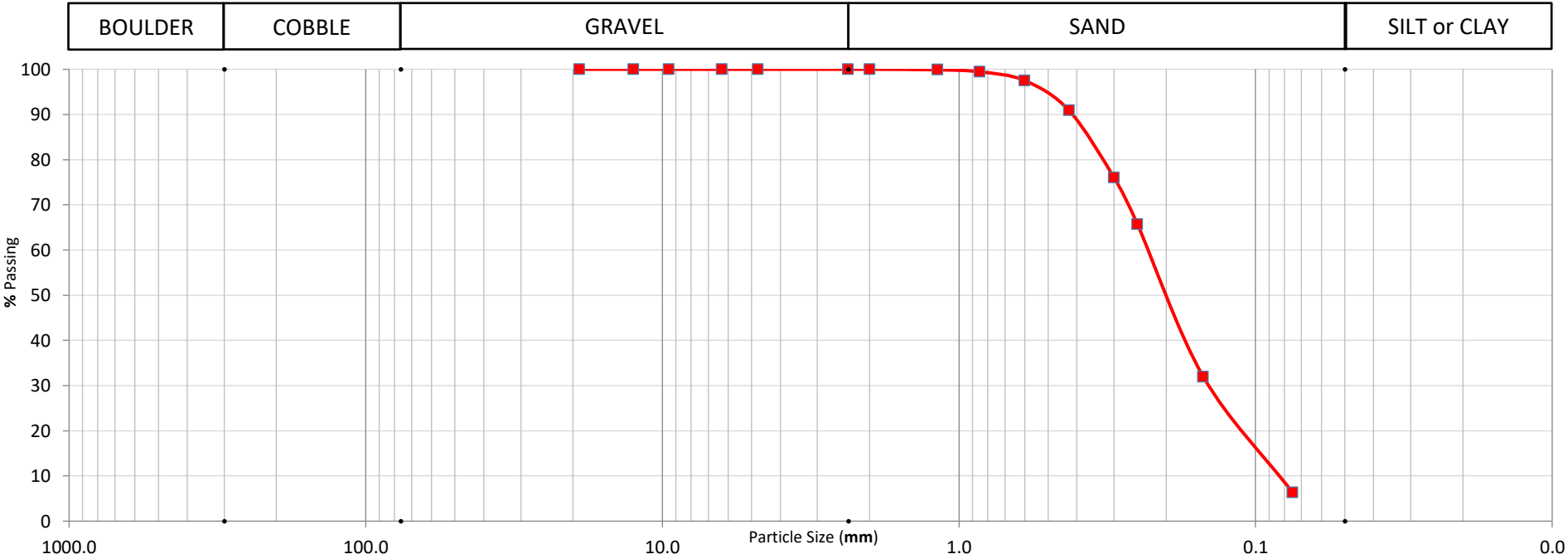
Source: Sand Cycloning Plant Date Sampled: 6-Nov-21

Location: TMF NSD Sec.1 Sand Cell N°11 (inplace)

Other: Sieve Analysis for Double Ring Infiltrometer Test-DRI-029

Wet Weight (g):	413.63
Moisture (%):	9.2
Orig. Dry Wt. (g):	378.70
Total Solid (%):	
Washed Oven Dry Wt. (g):	227.84
Washed Loss (g):	
Specific Gravity :	

Gravel	
Sand	93.6
Fines	6.4
Fineness Modulus	2.32



Sieve No	Sieve Size (mm)	Coarser Limit	Finer Limit	Ind. Ret. Wt. (g)	Cum. Ret. Wt. (g)	% Retained	% Passing
24"	600.0						
18"	450.0						
12"	300.0						
8"	200.0						
6"	150.0						
5"	125.0						
4"	100.0						
3"	75.0						
2 1/2"	63.0						
2"	50.0						
1.5"	37.5						
1"	25.0						
3/4"	19.0				0.00	0.0	100.0
1/2"	12.5				0.00	0.0	100.0
3/8"	9.5				0.00	0.0	100.0
1/4"	6.3				0.00	0.0	100.0

Sieve No	Sieve Size (mm)	Coarser Limit	Finer Limit	Ind. Ret. Wt. (g)	Cum. Ret. Wt. (g)	% Retained	% Passing
#4	4.75			0.00	0.00	0.0	100.0
#8	2.36			0.00	0.00	0.0	100.0
#10	2.00			0.00	0.00	0.0	100.0
#16	1.18			0.46	0.46	0.1	99.9
#20	0.85			1.67	2.13	0.6	99.4
#30	0.60			7.35	9.48	2.5	97.5
#40	0.425			25.15	34.63	9.1	90.9
#50	0.30			56.19	90.82	24.0	76.0
#60	0.25			39.19	130.01	34.3	65.7
#100	0.15			127.68	257.69	68.0	32.0
#200	0.075			96.95	354.64	93.6	6.4

Sample Identification		 FIRST QUANTUM MINERALS LTD. Cobre Panamá	
1	Informacion General (Informacion General)		
	Sample number (Numero de muestra):	MPSA-SC-185	
	sampled date (Fecha de muestreo:)	6-Nov-21	
2	Material Information (Informacion del Material)		
	Source (Fuente)	Sand Cycloning Plant	
	Work Area (Area de Trabajo)	TMF NSD Sec.1 Sand Cell N°11 (In Place)	
	Borrow - Foundation - Excavation - Crusher - Fill - Site Investigation - Other: Prestamo - Fundacion - Excavacion - Crusher - Relleno - Investigacion de Sitio - Otro:		
	Fill Zone (specs 1824-363-CI-SPC-0003): Zona de Material:		
	Material Type Tipo de Material	Cyclone Sand	Density Test cone Method for Double Ring Infiltration
	Remarks: Comentarios: Received: 17:40hrs		
	Using materials MPSA-RT-19018		
	Stations (along dam center line) Estaciones (Eje de Presa)	Start sta.:	End Sta.:
	Coordinates - GPS or Survey (Coordenadas - GPS o Topografia):	N: 983199	E: 537282
	Depth used to estimate elevation: (Profundidad a la que se tomo la muestra):	110mm	
	Recorded Ground elevation: (Elevacion del terreno)	El. 71.46m	
Technician:	Name: YG/AP	Signature:	
Lab Supervisor:	Name: CG	Signature:	

Form No. 1824-QC-LST-057 Rv02 Dual language

MINA COBRE PANAMA

Density and Unit Weight of Soil in Place by Sand-Cone Method
(ASTM D1556)



Sample Type: **Cyclone Sand**

Technician: **AP**

Location: **TMF NSD Sec.1 Sand Cell N°11 (In Place)**

Lab. No: **MPSA-SC-185**

Date Tested: **6-Nov-21**

Source: **Sand Cycloning Plant**

Fill Material Ref. No.:

Date Sampled: **6-Nov-21**

		110mm					
Coordinate (N, E)		983199 537282					
Elevation (m)		71.46m					
Test Hole Volume Determination							
Sand Cone Apparatus No.		1	1				
A. Mass of Sand in Container, Bef. Pouring (g)		6860					
B. Mass of Sand in Containerl, Aft. Pouring (g)		1499					
C. Mass of Sand in Funnel & Hole (g) (A-B)		5361					
D. Mass of Sand in Funnel (g) (frm Calib.)		1753					
E. Mass of Sand in Hole (g) (C-D)		3608					
F. Bulk Density of Sand (cm ³ /g) (frm Calib)		1.533					
G. Vol. of Test Hole (cm ³) (E/F)		2354					
Water Content Determination (Laboratory)							
Method Used	D2216	☐	☐	☐	☐	☐	☐
	D4643	☐	☐	☐	☐	☐	☐
	D4959	☒	☒	☐	☐	☐	☐
H. Mass of Container (g)		647					
I. Mass of Container+Moist Specimen (g)		1453					
J. Mass of Container+Dry Specimen (g)		1387					
K. Mass of Water (g) (I-J)		66					
L. Mass of Dry Specimen (g) (J-H)		740					
M. Water Content (%) (K/L)*100)		8.9					
Wet & Dry Density Determination (in-place)							
N. Moist Mass of Material from Hole (kg)		4398					
O. Dry Mass of Material from Hole (kg)		4038					
P. Wet Density of Tested Material (kg/m ³) (N/G)		1.869					
Q. Dry Density of Tested Material (Kg/m ³) (O/G)		1.716					
R. In-Situ Compaction (%) (Q/S)*100		111.6					
Laboratory Compaction							
S. Max. Dry Density (kg/m ³)		1.537					
T. Opt. Moist. Cont. (%)		18.3					

[illegible]



**Ensayo de
densidad, método
de cono de arena**

275° W
Donoso
Provincia de Colón
Altitud: 80.6m
Velocidad: 0.1km/h
Número de índice: 27
6 nov. 2021 16:13:19



**Ensayo de densidad,
método nuclear**

266° W
Donoso
Provincia de Colón
Altitud: 94.6m
Velocidad: 0.6km/h
Número de índice: 20
6 nov. 2021 15:13:34

Project Identification:		MPSA Cobre TMF					Constants		Area cm2		Depth of Liquid (cm)		Liquid Container Number				Marriotte Tube Volume		Marriotte Tube Area	
Test Location:		TMF NSD Sec.1 Sand Cell Nº11 (N983199, E537282 Z71.46m) Hydraulic Sand					Inner Ring		729		15.0						3000		54	
Liquid Used:		H ₂ O		pH: N/A		Annular Space		2189		15.0						10000		167		
Tested By:		Y. Guerra / A.Perez					Liquid level maintained using: () Flow Valve () Float Valve (X) Mariotte Tubes													
Fines %:		4.8					Penetration Depth of Outer Ring: 15cm													
Trial #	Start / End	Date MM/DD/YY	Time HR:MIN	Elapsed Time Chg/(Total) Min	Flow Readings				Liquid Temp C	Infiltration Rate				Ground Temperature		Remarks				
					Inner Ring Reading cm	Inner Marriotte Tube Flow (ml)	Annular Space Reading cm	Annular Space Marriotte Tube Flow (ml)		Inner Infiltration Rate cm/h	Inner Infiltration Rate cm/s	Annular Infiltration Rate cm/h	Annular Infiltration Rate cm/s	Ground Temp Depth (cm)	Temp at Depth (c)	Weather Conditions Etc...				
1	Start Test	11/06/21	0:00:00		57.5		56.5		32.0									Annular Ring H ₂ O Depth Initial: 15cm		
	End Test	11/06/21	0:00:30	0:00:30	55.2	124	55.8	117	32.0	20.386	5.663E-03	6.424	1.785E-03	30.0	30.2		Inner Ring H ₂ O Depth Initial: 15cm			
2	Start Test	11/06/21	0:00:30	0:00:30	55.2		55.8		32.0											
	End Test	11/06/21	0:01:00	0:01:00	51.6	194	54.6	201	32.0	31.909	8.863E-03	11.013	3.059E-03							
3	Start Test	11/06/21	0:01:00	0:00:30	51.6		54.6		32.0									Annular Ring H ₂ O Depth Final: 1.4cm		
	End Test	11/06/21	0:01:30	0:01:30	48.3	178	53.6	167	32.0	29.249	8.125E-03	9.178	2.549E-03				Inner Ring H ₂ O Depth Final: 0.5cm			
4	Start Test	11/06/21	0:01:30	0:00:30	48.3		53.6		32.0											
	End Test	11/06/21	0:02:00	0:02:00	45.0	178	52.5	184	32.0	29.249	8.125E-03	10.095	2.804E-03							
5	Start Test	11/06/21	0:02:00	0:00:30	45.0		52.5		32.0											
	End Test	11/06/21	0:02:30	0:02:30	42.1	156	51.4	184	32.0	25.704	7.140E-03	10.095	2.804E-03				Weather conditions: Sunny hot weather			
6	Start Test	11/06/21	0:02:30	0:00:30	42.1		51.4		32.0											
	End Test	11/06/21	0:03:00	0:03:00	39.2	156	50.3	184	32.0	25.704	7.140E-03	10.095	2.804E-03				Weather Temp: 31°C			
7	Start Test	11/06/21	0:03:00	0:00:30	39.2		50.3		32.0											
	End Test	11/06/21	0:03:30	0:03:30	36.5	145	49.2	184	32.0	23.931	6.648E-03	10.095	2.804E-03							
8	Start Test	11/06/21	0:03:30	0:00:30	36.5		49.2		32.0									Nuclear Density Test		
	End Test	11/06/21	0:04:00	0:04:00	33.8	145	48.2	167	32.0	23.931	6.648E-03	9.178	2.549E-03							
9	Start Test	11/06/21	0:04:00	0:00:30	33.8		48.2		32.0									W.D: 1865kg/m3		
	End Test	11/06/21	0:04:30	0:04:30	31.4	129	47.0	201	32.0	21.272	5.909E-03	11.013	3.059E-03							
10	Start Test	11/06/21	0:04:30	0:00:30	31.4		47.0		32.0									D.D: 1680kg/m3		
	End Test	11/06/21	0:05:00	0:05:00	28.8	140	45.9	184	32.0	23.045	6.401E-03	10.095	2.804E-03							
11	Start Test	11/06/21	0:05:00	0:00:30	28.8		45.9		32.0									M.C: 11.0%		
	End Test	11/06/21	0:05:30	0:05:30	26.6	118	44.8	184	32.0	19.500	5.417E-03	10.095	2.804E-03							
12	Start Test	11/06/21	0:05:30	0:00:30	26.6		44.8		32.0									Compaction: 109.3%		
	End Test	11/06/21	0:06:00	0:06:00	24.5	113	43.7	184	32.0	18.613	5.170E-03	10.095	2.804E-03							
13	Start Test	11/06/21	0:06:00	0:00:30	24.5		43.7		32.0											
	End Test	11/06/21	0:06:30	0:06:30	22.3	118	42.5	201	32.0	19.500	5.417E-03	11.013	3.059E-03				(Using MPSA-RT-19018 Standard Lab. Compaction M.D.D: 1537 -O.M.C: 18.3%) Hydraulic Sand			
14	Start Test	11/06/21	0:06:30	0:00:30	22.3		42.5		32.0											
	End Test	11/06/21	0:07:00	0:07:00	20.3	108	41.4	184	32.0	17.727	4.924E-03	10.095	2.804E-03							
15	Start Test	11/06/21	0:07:00	0:00:30	20.3		41.4		32.0											
	End Test	11/06/21	0:07:30	0:07:30	18.4	102	40.2	201	32.0	16.841	4.678E-03	11.013	3.059E-03							
16	Start Test	11/06/21	0:07:30	0:00:30	18.4		40.2		32.0											
	End Test	11/06/21	0:08:00	0:08:00	16.2	118	39.1	184	32.0	19.500	5.417E-03	10.095	2.804E-03							
17	Start Test	11/06/21	0:08:00	0:00:30	16.2		39.1		32.0											
	End Test	11/06/21	0:08:30	0:08:30	14.5	92	37.9	201	32.0	15.068	4.186E-03	11.013	3.059E-03							
18	Start Test	11/06/21	0:08:30	0:00:30	14.5		37.9		32.0											
	End Test	11/06/21	0:09:00	0:09:00	12.5	108	36.8	184	32.0	17.727	4.924E-03	10.095	2.804E-03							
19	Start Test	11/06/21	0:09:00	0:00:30	12.5		36.8		32.0											
	End Test	11/06/21	0:09:30	0:09:30	10.6	102	35.7	184	32.0	16.841	4.678E-03	10.095	2.804E-03							
20	Start Test	11/06/21	0:09:30	0:00:30	10.6		35.7		32.0											
	End Test	11/06/21	0:10:00	0:10:00	8.8	97	34.5	201	32.0	15.954	4.432E-03	11.013	3.059E-03							
21	Start Test	11/06/21	0:10:00	0:00:30	8.8		34.5		32.0											
	End Test	11/06/21	0:10:30	0:10:30	7.4	75	33.3	201	32.0	12.409	3.447E-03	11.013	3.059E-03							
22	Start Test	11/06/21	0:10:30	0:00:30	7.4		33.3		32.0											
	End Test	11/06/21	0:11:00	0:11:00	5.5	102	32.1	201	32.0	16.841	4.678E-03	11.013	3.059E-03							
23	Start Test	11/06/21	0:11:00	0:00:30	5.5		32.1		32.0											
	End Test	11/06/21	0:11:30	0:11:30	4.0	81	30.9	201	32.0	13.295	3.693E-03	11.013	3.059E-03							
24	Start Test	11/06/21	0:11:30	0:00:30	4.0		30.9		32.0											
	End Test	11/06/21	0:12:00	0:12:00	2.3	92	29.8	184	32.0	15.068	4.186E-03	10.095	2.804E-03							
25	Start Test	11/06/21	0:12:00	0:00:30	2.3		29.8		32.0											
	End Test	11/06/21	0:12:30	0:12:30	0.7	86	28.6	201	32.0	14.182	3.939E-03	11.013	3.059E-03							



187° S
Donoso
Provincia de Colón
Altitud: 84.3m
Velocidad: 0.3km/h
Número de índice: 23
6 nov. 2021 15:49:43

Date:	8-Nov-21	Location: TMF NSD Sec.1 Sand Cell N#11		N	983199
Sample ID:	MPSA-PERM-029			E	537282
Material:	Cyclone U/F Sand (Hydraulic Placement)			Elev.(m)	71.46m
Fines Content:	6.4%				
Source:	Sand Cycloning Plant				
Technician:	YG / DS	Date Tested	08-Nov-21		

Enter Data

SPECIFICATION: > 1.00E-04 cm/s

Viscosity Factor (v25/v20)=	0.5629348514
Viscosity Factor (v26/v20)=	0.5503478811

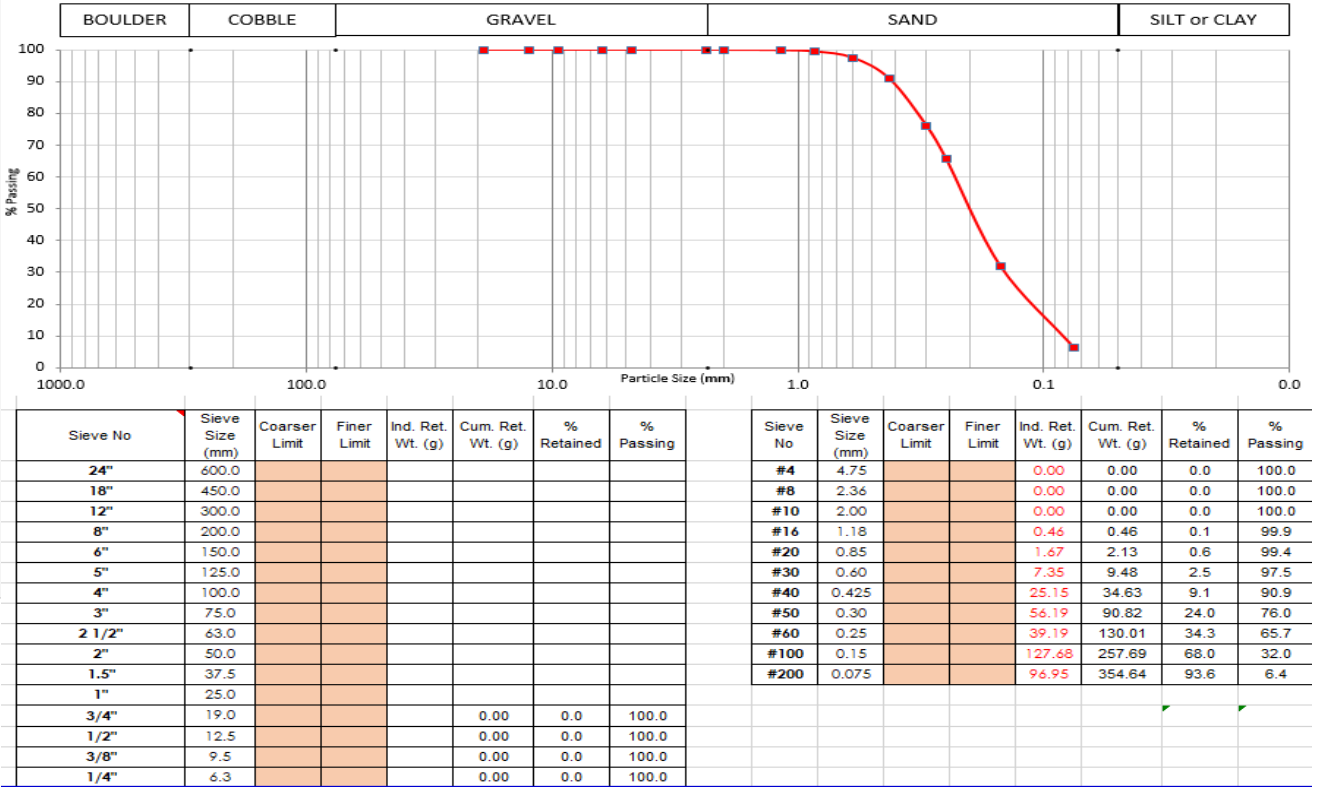
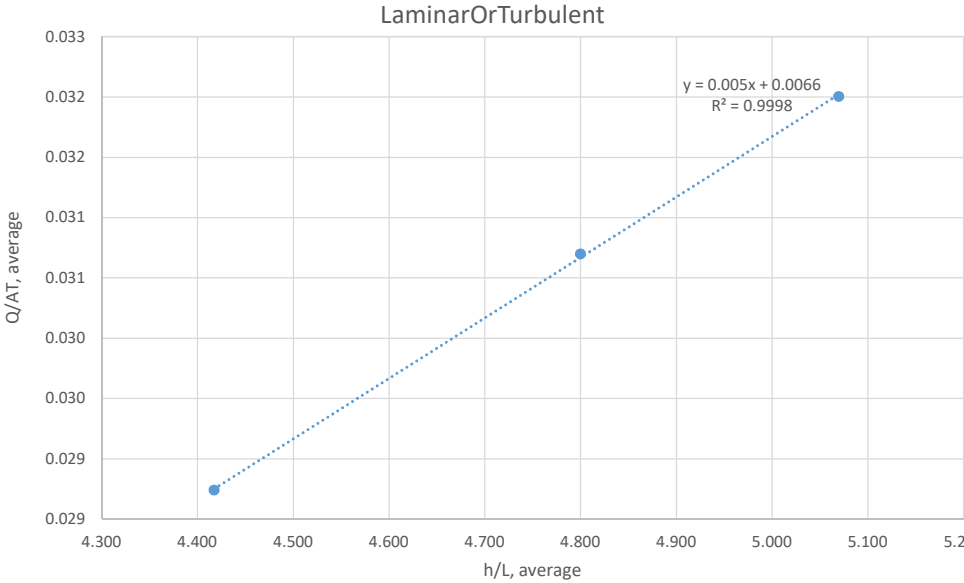
Flow Laminarity	Test	H1 (cm)	H2 (cm)	h (cm)	Q (cm3, mL)	t (s)	Q/At	Average Q/At	h/L	Average, h/L	T (°C)	k, cm/s	k, m/s	k, m/s, corrected	Average k, m/s, corrected	Average k, cm/s, corrected
0 height	1	81.8	23.4	58.4	98	30	0.032004	0.032	5.078260870	5.070	25	6.30E-03	6.30219E-05	3.54772E-05	3.55382E-05	3.5538E-03
	2	81.7	23.4	58.3	98	30	0.032004		5.069565217		25	6.31E-03	6.313E-05	3.55381E-05		
	3	81.6	23.4	58.2	98	30	0.032004		5.060869565		25	6.32E-03	6.32385E-05	3.55992E-05		
Δ5cm height	4	83.4	28.2	55.2	94	30	0.030698	0.031	4.800000000	4.800	25	6.40E-03	6.39539E-05	3.60019E-05	3.60020E-05	3.6002E-03
	5	83.5	28.2	55.3	94	30	0.030698		4.808695652		25	6.38E-03	6.38383E-05	3.59368E-05		
	6	83.3	28.2	55.1	94	30	0.030698		4.791304348		25	6.41E-03	6.407E-05	3.60672E-05		
Δ10cm height	7	83	32.2	50.8	88	30	0.028738	0.029	4.417391304	4.417	25	6.51E-03	6.50575E-05	3.66231E-05	3.60772E-05	3.6077E-03
	8	83	32.2	50.8	87	30	0.028412		4.417391304		26	6.43E-03	6.43182E-05	3.53974E-05		
	9	83	32.2	50.8	89	30	0.029065		4.417391304		26	6.58E-03	6.57968E-05	3.62111E-05		

MDD (g/cm3)	1.537
OMC	18.30

Area (cm2)=	102.07
Length between manometers (cm)=	11.50
Mass (perm.), g	2204.50

100% Compaction Height of Specimen (cm)	18.00
Final Height of Specimen (cm)	18.00
V (perm., cm3) at 18cm height	1837.26
Specimen Moisture Cntnt	17.90
Mass (wet) required for 6x 3cm compacted layers at 100% PRMDD	3329.34
Mass Final of Compacted Specimen	3329.60
Final Volume of Specimen (cm3)	1837.26
Dry Unit Weight	1.537
% Compaction	100.0

Void Ratio, e
Reltive Density, RD



Sample Identification		 FIRST QUANTUM MINERALS LTD.		Cobre Panamá
1	Informacion General (<i>Informacion General</i>)			
	Sample number (<i>Numero de muestra</i>):		MPSA-RT-DRI-030	
	sampled date (<i>Fecha de muestreo</i>):		10-Nov-21	
2	Material Information (<i>Informacion del Material</i>)			
	Source (<i>Fuente</i>)	Sand Cycloning Plant		
	Work Area (<i>Area de Trabajo</i>)	TMF NSD Sec.1 Sand Cell N°11 (inplace)		
	Borrow - Foundation - Excavation - Crusher - Fill - Site Investigation - Other: Plant <i>Prestamo - Fundacion - Excavacion - Crusher - Relleno - Investigacion de Sitio - Otro:</i>			
	Fill Zone (specs 1824-363-CI-SPC-0003): <i>Zona de Material:</i>			
	Material Type <i>Tipo de Material</i>		Cyclone Sand (Hydraulic)	Sieve Analysis for Double Ring Infiltrimeter Test-DRI-029
	Remarks: <i>Comentarios:</i> Received: 17:40hrs, Complete Test: 20:25hrs			
	Hydraulically Placed and Compacted.			
		Start sta.:	End Sta.:	
	Coordinates - GPS or Survey (<i>Coordenadas - GPS o Topografia</i>):	N: 983199	E: 537282	
	Depth used to estimate elevation: (<i>Profundidad a la que se tomo la muestra</i>):	300mm		
	Recorded Ground elevation: (<i>Elevacion del terreno</i>)	El. 71.46m		
Technician:	Name: YG/AP		Signature:	
Lab Supervisor:	Name: CG		Signature:	

Form No. 1824-QC-LST-057 Rv02 Dual language

MINA COBRE PANAMA
Material Finer than 75mic. Sieve in Soil by Washing (ASTM D1140)



Sample Type:

Cyclone Sand (Hydraulic)

Technician:

AP/YG

Sample No:

MPSA-RT-DRI-030

Date Tested:

6-Nov-21

Source:

Sand Cycloning Plant

Date Sampled:

10-Nov-21

Location:

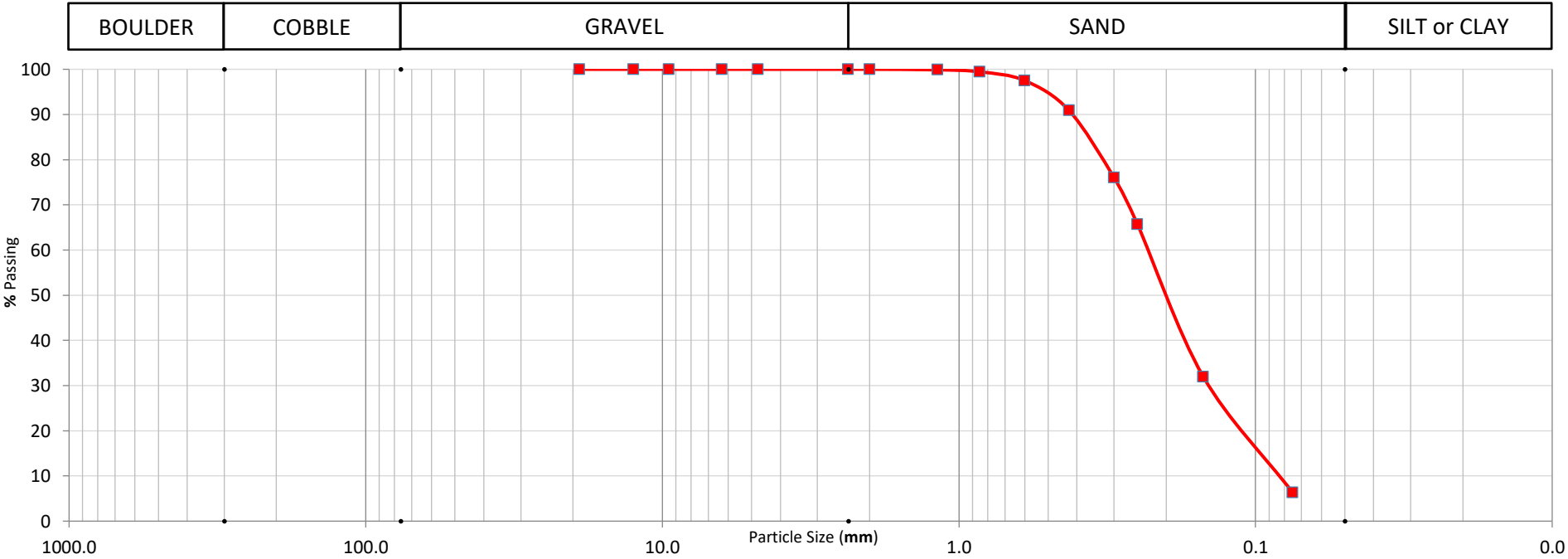
TMF NSD Sec.1 Sand Cell N°11 (inplace)

Other:

Sieve Analysis for Double Ring
Infiltrometer Test-DRI-029

Wet Weight (g):	413.63
Moisture (%):	9.2
Orig. Dry Wt. (g):	378.70
Total Solid (%):	
Washed Oven Dry Wt. (g):	227.84
Washed Loss (g):	
Specific Gravity :	

Gravel	
Sand	93.6
Fines	6.4
Fineness Modulus	2.32



Sieve No	Sieve Size (mm)	Coarser Limit	Finer Limit	Ind. Ret. Wt. (g)	Cum. Ret. Wt. (g)	% Retained	% Passing
24"	600.0						
18"	450.0						
12"	300.0						
8"	200.0						
6"	150.0						
5"	125.0						
4"	100.0						
3"	75.0						
2 1/2"	63.0						
2"	50.0						
1.5"	37.5						
1"	25.0						
3/4"	19.0				0.00	0.0	100.0
1/2"	12.5				0.00	0.0	100.0
3/8"	9.5				0.00	0.0	100.0
1/4"	6.3				0.00	0.0	100.0

Sieve No	Sieve Size (mm)	Coarser Limit	Finer Limit	Ind. Ret. Wt. (g)	Cum. Ret. Wt. (g)	% Retained	% Passing
#4	4.75			0.00	0.00	0.0	100.0
#8	2.36			0.00	0.00	0.0	100.0
#10	2.00			0.00	0.00	0.0	100.0
#16	1.18			0.46	0.46	0.1	99.9
#20	0.85			1.67	2.13	0.6	99.4
#30	0.60			7.35	9.48	2.5	97.5
#40	0.425			25.15	34.63	9.1	90.9
#50	0.30			56.19	90.82	24.0	76.0
#60	0.25			39.19	130.01	34.3	65.7
#100	0.15			127.68	257.69	68.0	32.0
#200	0.075			96.95	354.64	93.6	6.4

Sample Identification		 FIRST QUANTUM MINERALS LTD. Cobre Panamá	
1	Informacion General (Informacion General)		
	Sample number (Numero de muestra):	MPSA-SC-187	
	sampld date (Fecha de muestreo:)	10-Nov-21	
2	Material Information (Informacion del Material)		
	Source (Fuente)	Sand Cyclone Plant	
	Work Area (Area de Trabajo)	TMF NSD Sec1 Sand Cell N°12 (In Place)	
	Borrow - Foundation - Excavation - Crusher - Fill - Site Investigation - Other: Prestamo - Fundacion - Excavacion - Crusher - Relleno - Investigacion de Sitio - Otro:		
	Fill Zone (specs 1824-363-CI-SPC-0003): Zona de Material:		
	Material Type Tipo de Material	Cyclone Sand	Standard Test Method for Density By Sand Cone Test Method for DRI Test
	Remarks: Comentarios: Received: 10:30hrs Complete Test: 18:00hrs		
	Using materials MPSA-19421		
	Stations (along dam center line) Estaciones (Eje de Presa)	Start sta.:	End Sta.:
	Coordinates - GPS or Survey (Coordenadas - GPS o Topografia):	N: 983176	E: 537163
	Depth used to estimate elevation: (Profundidad a la que se tomo la muestra):	110mm	
	Recorded Ground elevation: (Elevacion del terreno)	EL. 71.46m	
Technician:	Name: YG/DS	Signature:	
Lab Supervisor:	Name: CG	Signature:	

Form No. 1824-QC-LST-057 Rv02 Dual language

MINA COBRE PANAMA

Standard Test Method for Density and Unit Weight of Soil in Place by Sand-Cone Method
(ASTM D1556)



Sample Type:

Cyclone Sand

Technician:

YG

Location:

TMF NSD Sec1 Sand Cell N°12 (In Place)

Lab. No.:

MPSA-SC-187

Date Tested:

10-Nov-21

Source:

Sand Cyclone Plant

Fill Material Ref. No.:

Using materials MPSA-19421

Date Sampled:

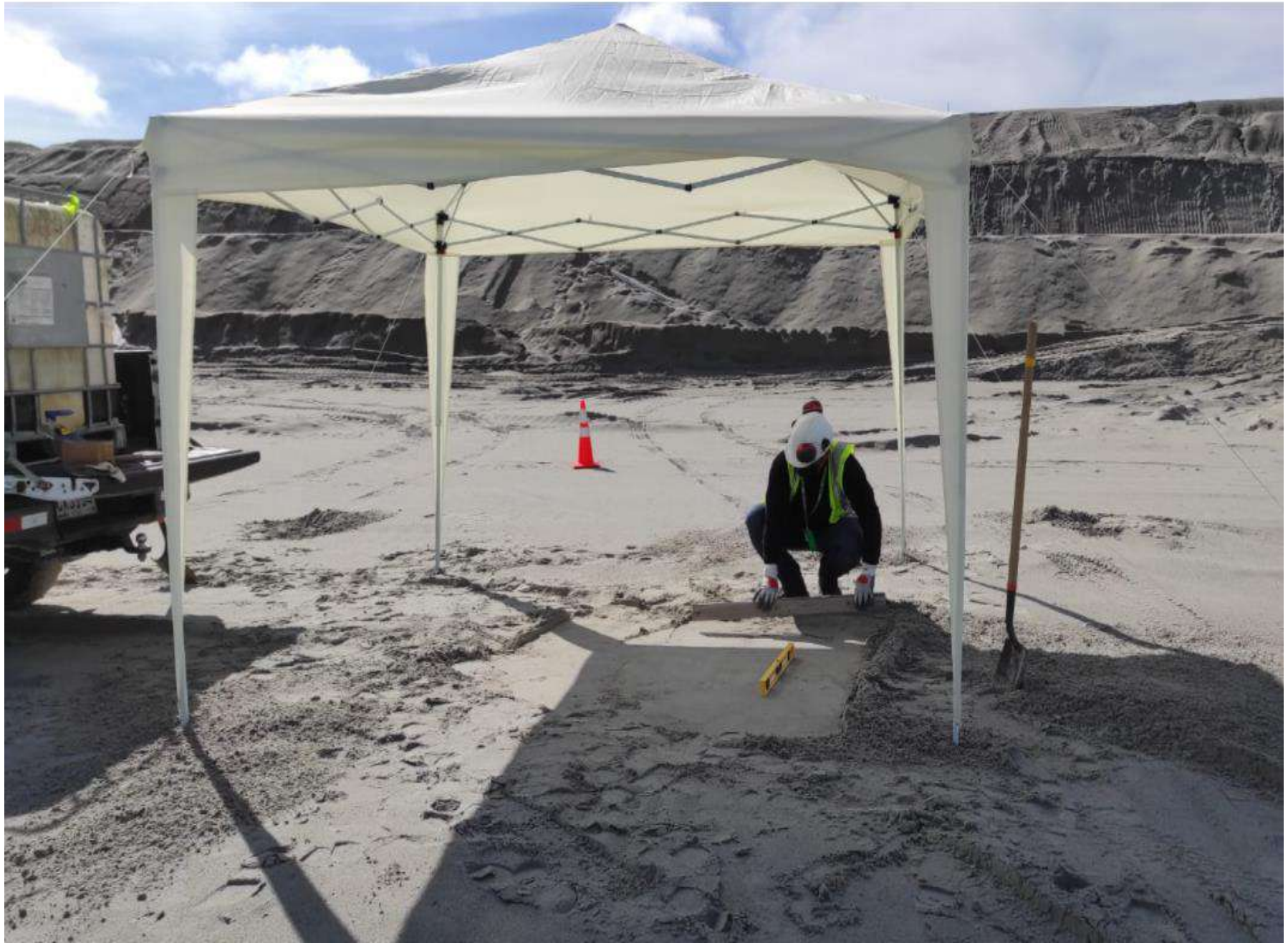
10-Nov-21

Prueba No.	1					
Coordenadas (N, E)	983176 537163					
Elevacion (m)	EL. 71.46m					
Determinación del volumen del hueco de prueba						
Aparato de cono de arena No.	#1					
Fecha de calibracio del cono	10/22/2021					
A. Masa de arena en contenedor, Ant. Vertido (g)	7030					
B. Masa de arena en contenedor, Des. Vertido (g)	1815					
C. Masa de arena Utilizada (g) (A-B)	5215					
D. Masa de arena en embudo (g) (frm Calib).	1753					
E. Masa de arena en el Hueco (g) (C-D)	3462					
F. Densidad aparente de la arena (km / m3) (frm Calib)	1.533					
G. Vol. de l hueco de prueba (cm3) (E/F)	2258					
Determinación del contenido de Humedad (laboratorio)						
Método utilizado	D2216	☐	☐	☐	☐	☐
	D4643	☐	☐	☐	☐	☐
	D4959	☒	☐	☐	☐	☐
H. Masa del contenedor (g)	355					
I. Masa del recipiente + muestra húmeda (g)	747					
J. Masa del recipiente + Muestra seca (g)	722					
K. Masa de agua (g) (I-J)	25					
L. Masa de muestra seca (g) (J-H)	367					
M. Contenido de agua (%) (K/L)*100	6.8					
Determinación de densidad húmeda y seca (in situ)						
N. Masa húmeda de material del orificio (g)	3778					
O. Masa seca de material en el hueco (g)	3537					
P. Densidad húmeda del material probado (kg/m³) (N/G)	1.673					
Q. Densidad seca del material probado (Kg/m³) (O/G)	1.566					
R. Compactación in situ (%) (Q/S)*100	100.7					
Compactación de laboratorio						
S. Max. Densidad seca (kg/m³)	1.556				NOTA: Equipo utilizado / 79072 de (ITP)	
T. Opt. Húmedo. Cont. (%)	18.3					

[illegible]



Project Identification: MPSA Cobre TMF					Constants		Area cm2	Depth of Liquid (cm)	Liquid Container Number					Marriotte Tube Volume		Marriotte Tube Area		
Test Location: TMF NSD Sec 1 Sand Cell NP12 (N983176, E537163 271.46m) Hydraulic Sand					Inner Ring	729	15.0							3000				
Liquid Used: H ₂ O pH: N/A					Annular Space	2189	15.0							10000	54			
Tested By: Y. Guerra / D. Sanchez					Liquid level maintained using: () Flow Valve () Float Valve (X) Marriotte Tubes												167	
Fines % 4.8					Penetration Depth of Outer Ring: 15cm													
					Flow Readings					Infiltration Rate					Ground Temperature		Remarks	
Trial #	Start / End	Date MM/DD/YY	Time HR:MIN	Elapsed Time Chg(Total) Min	Inner Ring Reading cm	Inner Marriotte Tube Flow (ml)	Annular Space Reading cm	Annular Space Marriotte Tube Flow (ml)	Liquid Temp C	Inner Infiltration Rate cm/h	Inner Infiltration Rate cm/s	Annular Infiltration Rate cm/h	Annular Infiltration Rate cm/s	Ground Temp Depth (cm)	Temp at Depth (c)	Weather Conditions Etc...		
1	Start Test	11/10/21	0:00:00		58.2		57.7		28.5								Annular Ring H ₂ O Depth Initial: 15cm	
	End Test	11/10/21	0:00:30	0:00:30	57.5	38	56.7	167	28.5	6.204	1.723E-03	9.178	2.549E-03	30.0	28.2	Inner Ring H ₂ O Depth Initial: 15cm		
	Start Test	11/10/21	0:00:30	0:00:30	57.5		56.7		28.5									
2	End Test	11/10/21	0:01:00	0:01:00	55.8	92	55.6	184	28.5	15.068	4.186E-03	10.095	2.804E-03					
	Start Test	11/10/21	0:01:00	0:00:30	55.8		55.6		28.5								Annular Ring H ₂ O Depth Final: 4.5cm	
	End Test	11/10/21	0:01:30	0:01:30	53.9	102	54.5	184	28.5	16.841	4.678E-03	10.095	2.804E-03				Inner Ring H ₂ O Depth Final: 1.7cm	
3	Start Test	11/10/21	0:01:30	0:00:30	53.9		54.5		28.5									
	End Test	11/10/21	0:02:00	0:02:00	52.0	102	53.4	184	28.5	16.841	4.678E-03	10.095	2.804E-03					
	Start Test	11/10/21	0:02:00	0:00:30	52.0		53.4		28.5									
4	End Test	11/10/21	0:02:30	0:02:30	50.1	102	52.3	184	28.5	16.841	4.678E-03	10.095	2.804E-03			Weather conditions: Rainy day weather		
	Start Test	11/10/21	0:02:30	0:00:30	50.1		52.3		28.5									
	End Test	11/10/21	0:03:00	0:03:00	48.1	108	51.1	201	28.5	17.727	4.924E-03	11.013	3.059E-03			Weather Temp: 29°C		
5	Start Test	11/10/21	0:03:00	0:00:30	48.1		51.1		28.5									
	End Test	11/10/21	0:03:30	0:03:30	46.0	113	49.8	218	28.5	18.613	5.170E-03	11.931	3.314E-03					
	Start Test	11/10/21	0:03:30	0:00:30	46.0		49.8		28.5								Nuclear Density Test	
6	End Test	11/10/21	0:04:00	0:04:00	44.1	102	46.6	201	28.5	16.841	4.678E-03	11.013	3.059E-03					
	Start Test	11/10/21	0:04:00	0:00:30	44.1		46.6		28.5								W.D: 1743 kg/m3	
	End Test	11/10/21	0:04:30	0:04:30	41.9	118	47.3	218	28.5	19.500	5.417E-03	11.931	3.314E-03					
7	Start Test	11/10/21	0:04:30	0:00:30	41.9		47.3		28.5								D.D: 1598 kg/m3	
	End Test	11/10/21	0:05:00	0:05:00	39.9	108	39.9	218	28.5	17.727	4.924E-03	11.931	3.314E-03					
	Start Test	11/10/21	0:05:00	0:00:30	39.9		46.0		28.5								M.C: 9.1%	
8	End Test	11/10/21	0:05:30	0:05:30	38.2	92	44.8	201	28.5	15.068	4.186E-03	11.013	3.059E-03					
	Start Test	11/10/21	0:05:30	0:00:30	38.2		44.8		28.5								Compaction: 102.7%	
	End Test	11/10/21	0:06:00	0:06:00	36.4	97	43.5	218	28.5	15.954	4.432E-03	11.931	3.314E-03					
9	Start Test	11/10/21	0:06:00	0:00:30	36.4		43.5		28.5									
	End Test	11/10/21	0:06:30	0:06:30	34.5	102	42.2	218	28.5	16.841	4.678E-03	11.931	3.314E-03			(Using MPSA-RT-19421 Standard Lab. Compaction M.D.D: 1556 -O.M.C: 18.3%) Hydraulic Sand		
	Start Test	11/10/21	0:06:30	0:00:30	34.5		42.2		28.5									
10	End Test	11/10/21	0:07:00	0:07:00	32.6	102	40.8	234	28.5	16.841	4.678E-03	12.849	3.569E-03					
	Start Test	11/10/21	0:07:00	0:00:30	32.6		40.8		28.5									
	End Test	11/10/21	0:07:30	0:07:30	30.8	97	39.4	234	28.5	15.954	4.432E-03	12.849	3.569E-03					
11	Start Test	11/10/21	0:07:30	0:00:30	30.8		39.4		28.5									
	End Test	11/10/21	0:08:00	0:08:00	28.8	108	38.0	234	28.5	17.727	4.924E-03	12.849	3.569E-03					
	Start Test	11/10/21	0:08:00	0:00:30	28.8		38.0		28.5									
12	End Test	11/10/21	0:08:30	0:08:30	26.7	113	36.6	234	28.5	18.613	5.170E-03	12.849	3.569E-03					
	Start Test	11/10/21	0:08:30	0:00:30	26.7		36.6		28.5									
	End Test	11/10/21	0:09:00	0:09:00	24.8	102	35.2	234	28.5	16.841	4.678E-03	12.849	3.569E-03					
13	Start Test	11/10/21	0:09:00	0:00:30	24.8		35.2		28.5									
	End Test	11/10/21	0:09:30	0:09:30	22.8	108	33.7	251	28.5	17.727	4.924E-03	13.766	3.824E-03					
	Start Test	11/10/21	0:09:30	0:00:30	22.8		33.7		28.5									
14	End Test	11/10/21	0:10:00	0:10:00	20.8	108	32.4	218	28.5	17.727	4.924E-03	11.931	3.314E-03					
	Start Test	11/10/21	0:10:00	0:00:30	20.8		32.4		28.5									
	End Test	11/10/21	0:10:30	0:10:30	18.8	108	30.9	251	28.5	17.727	4.924E-03	13.766	3.824E-03					
15	Start Test	11/10/21	0:10:30	0:00:30	18.8		30.9		28.5									
	End Test	11/10/21	0:11:00	0:11:00	16.5	124	29.4	251	28.5	20.386	5.663E-03	13.766	3.824E-03					
	Start Test	11/10/21	0:11:00	0:00:30	16.5		29.4		28.5									
16	End Test	11/10/21	0:11:30	0:11:30	14.4	113	27.9	251	28.5	18.613	5.170E-03	13.766	3.824E-03					
	Start Test	11/10/21	0:11:30	0:00:30	14.4		27.9		28.5									
	End Test	11/10/21	0:12:00	0:12:00	12.2	118	26.4	251	28.5	19.500	5.417E-03	13.766	3.824E-03					
17	Start Test	11/10/21	0:12:00	0:00:30	12.2		26.4		28.5									
	End Test	11/10/21	0:12:30	0:12:30	10.0	118	24.9	251	28.5	19.500	5.417E-03	13.766	3.824E-03					
	Start Test	11/10/21	0:12:30	0:00:30	10.0		24.9		28.5									
18	End Test	11/10/21	0:13:00	0:13:00	7.7	124	23.3	268	28.5	20.386	5.663E-03	14.684	4.079E-03					
	Start Test	11/10/21	0:13:00	0:00:30	7.7		23.3		28.5									
	End Test	11/10/21	0:13:30	0:13:30	5.5	118	21.5	301	28.5	19.500	5.417E-03	16.520	4.589E-03					
19	Start Test	11/10/21	0:13:30	0:00:30	5.5		21.5		28.5									
	End Test	11/10/21	0:14:00	0:14:00	3.4	113	20.2	218	28.5	18.613	5.170E-03	11.931	3.314E-03					
	Start Test	11/10/21	0:14:00	0:00:30	3.4		20.2		28.5									
20	End Test	11/10/21	0:14:30	0:14:30	1.1	124	18.7	251	28.5	20.386	5.663E-03	13.766	3.824E-03					
	Start Test	11/10/21	0:14:30	0:00:30	16.6		29.6		28.5									
	End Test	11/10/21	0:15:00	0:15:00	15.4	65	28.5	184	28.5	10.636	2.954E-03	10.095	2.804E-03					
21	Start Test	11/10/21	0:15:00	0:00:30	15.4		28.5		28.5									
	End Test	11/10/21	0:15:30	0:15:30	14.0	75	27.5	167	28.5	12.409	3.447E-03	9.178	2.549E-03					
	Start Test	11/10/21	0:15:30	0:00:30	14.0		27.5		28.5									
22	End Test	11/10/21	0:16:00	0:16:00	12.6	75	26.4	184	28.5	12.409	3.447E-03	10.095	2.804E-03					
	Start Test	11/10/21	0:16:00	0:00:30	12.6		26.4		28.5									
	End Test	11/10/21	0:16:30	0:16:30	11.2	75	25.4	167	28.5	12.409	3.447E-03	9.178	2.549E-03					
23	Start Test	11/10/21	0:16:30	0:00:30	11.2		25.4		28.5									
	End Test	11/10/21	0:17:00	0:17:00	9.8	75	24.3	184	28.5	12.409	3.447E-03	10.095	2.804E-03					
	Start Test	11/10/21	0:17:00	0:00:30	9.8		24.3		28.5									
24	End Test	11/10/21	0:17:30	0:17:30	8.4	75	23.3	167	28.5	12.409	3.447E-03	9.178	2.549E-03					
	Start Test	11/10/21	0:17:30	0:00:30	8.4		23.3		28.5									
	End Test	11/10/21	0:18:00	0:18:00	6.9	81	22.2	184	28.5	13.295	3.693E-03	10.095	2.804E-03					
25	Start Test	11/10/21	0:18:00	0:00:30	6.9		22.2		28.5									
	End Test	11/10/21	0:18:30	0:18:30	5.5	75	21.0	201	28.5	12.409	3.447E-03	11.013	3.059E-03					
	Start Test	11/10/21	0:18:30	0:00:30	5.5		21.0		28.5									
26	End Test	11/10/21	0:19:00	0:19:00	4.2	70	20.0	167	28.5	11.523	3.201E-03	9.178	2.549E-03					
	Start Test	11/10/21	0:19:00	0:00:30	4.2		20.0		28.5									
	End Test	11/10/21	0:19:30	0:19:30	2.7	81	18.9	184	28.5	13.295	3.693E-03	10.095	2.804E-03					
27	Start Test	11/10/21	0:19:30	0:00:30	2.7		18.9		28.5									
	End Test	11/10/21	0:20:00	0:20:00	1.2	81	17.8	184	28.5	13.295	3.693E-03	10.095	2.804E-03					













Date:	10-Nov-21	Location: TMF NSD Sec.1 Sand Cell N°12		N	983176
Sample ID:	MPSA-PERM-030			E	537163
Material:	Cyclone U/F Sand (Hydraulic Placement)			Elev.(m)	71.46m
Fines Content:	6.4%				
Source:	Sand Cycloning Plant				
Technician:	YG / AP	Date Tested	12-Nov-21		

Enter Data

SPECIFICATION: > 1.00E-04 cm/s

Viscosity Factor (v22/v20)=	0.6036685642
Viscosity Factor (v23/v20)=	0.5895635674

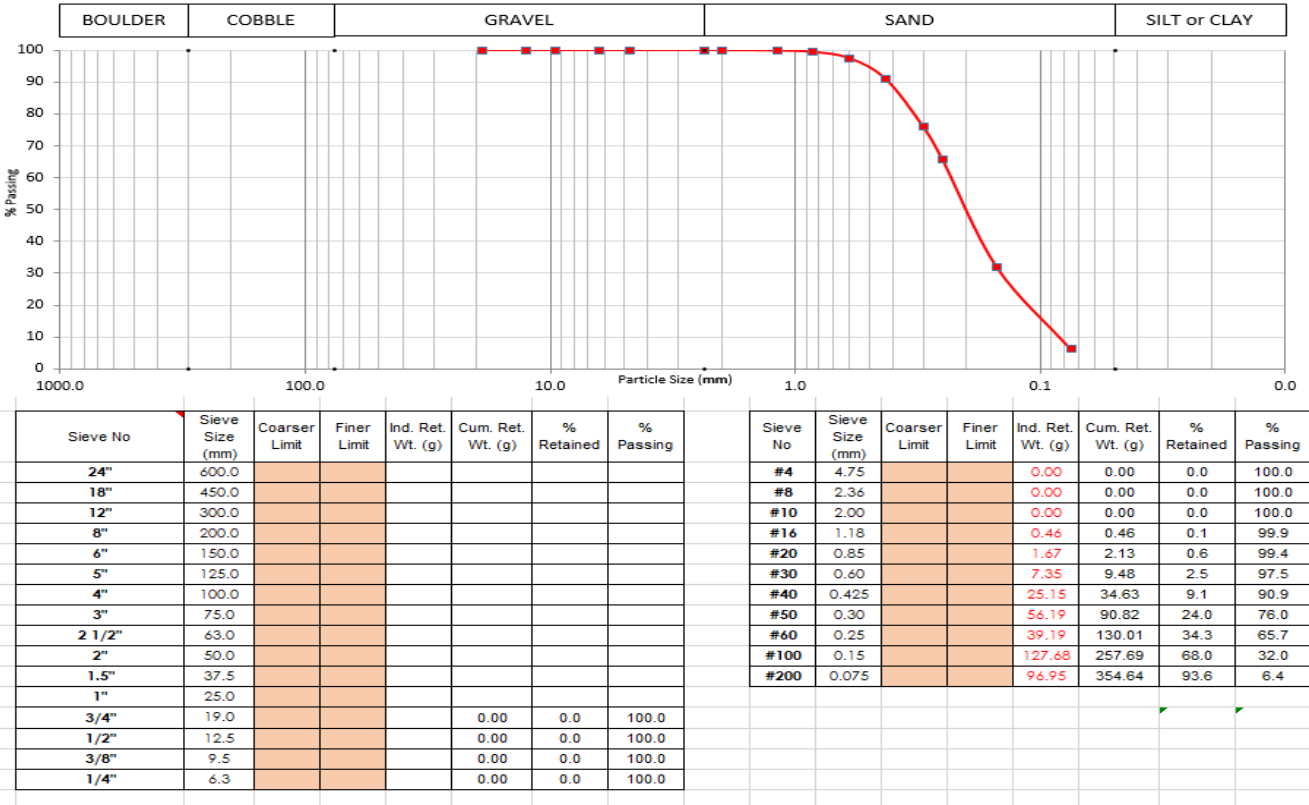
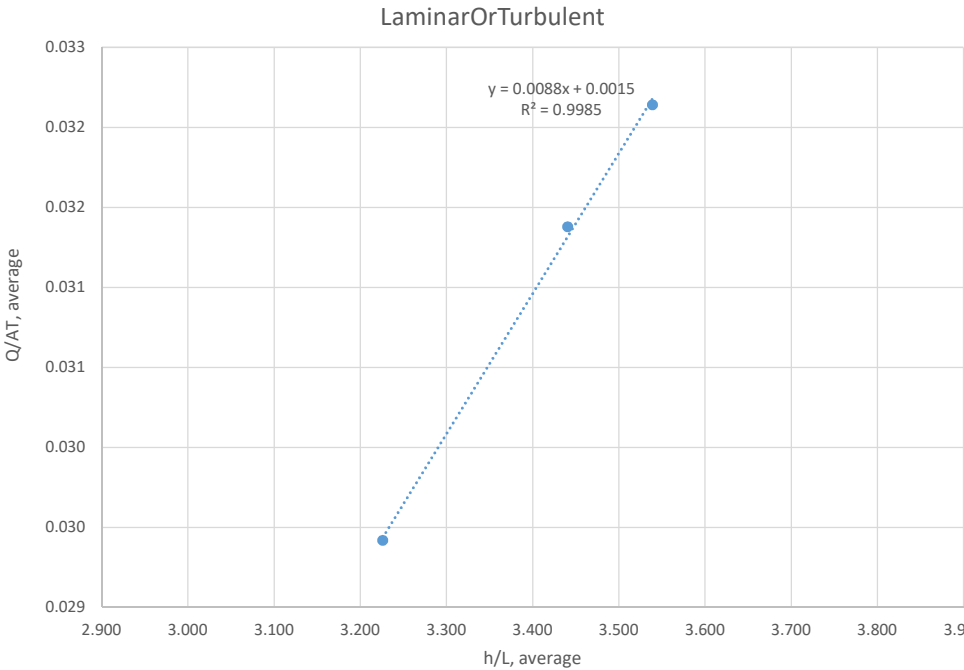
Flow Laminarity	Test	H1 (cm)	H2 (cm)	h (cm)	Q (cm3, mL)	t (s)	Q/At	Average Q/At	h/L	Average, h/L	T (°C)	k, cm/s	k, m/s	k, m/s, corrected	Average k, m/s, corrected	Average k, cm/s, corrected
0 height	1	77	36.3	40.7	100	30	0.032657	0.032	3.539130435	3.539	22	9.23E-03	9.22750E-05	5.57035E-05	5.53322E-05	5.5332E-03
	2	77	36.3	40.7	99	30	0.032331		3.539130435		22	9.14E-03	9.13523E-05	5.51465E-05		
	3	77	36.3	40.7	99	30	0.032331		3.539130435		22	9.14E-03	9.13523E-05	5.51465E-05		
Δ5cm height	4	77.8	38.7	39.1	97	30	0.031678	0.032	3.400000000	3.441	22	9.32E-03	9.31694E-05	5.62435E-05	5.51725E-05	5.5172E-03
	5	77.8	38.7	39.1	97	30	0.031678		3.4		22	9.32E-03	9.31694E-05	5.62435E-05		
	6	78.9	38.4	40.5	97	30	0.031678		3.52173913		23	8.99E-03	8.99488E-05	5.30305E-05		
Δ10cm height	7	79	41.9	37.1	91	30	0.029718	0.030	3.226086957	3.226	23	9.21E-03	9.21183E-05	5.43096E-05	5.43096E-05	5.4310E-03
	8	79	41.9	37.1	91	30	0.029718		3.226086957		23	9.21E-03	9.21183E-05	5.43096E-05		
	9	79	41.9	37.1	91	30	0.029718		3.226086957		23	9.21E-03	9.21183E-05	5.43096E-05		

MDD (g/cm3)	1.556
OMC	18.30

Area (cm2)= 102.07
Length between manometers (cm)= 11.50
Mass (perm.), g 2204.50

100% Compaction Height of Specimen (cm) 18.00
Final Height of Specimen (cm) 18.00
V (perm., cm3) at 18cm height 1837.26
Specimen Moisture Cntnt 18.10
Mass (wet) required for 6x 3cm compacted layers at 100% PRMDD 3376.22
Mass Final of Compacted Specimen 3376.80
Final Volume of Specimen (cm3) 1837.26
Dry Unit Weight 1.556
% Compaction 100.0

Void Ratio, e
Reltive Density, RD



Sample Identification		 FIRST QUANTUM MINERALS LTD.		Cobre Panamá
1	Informacion General (Informacion General)			
	Sample number (Numero de muestra):		MPSA-RT-DRI-031	
	sampled date (Fecha de muestreo:)		11-Nov-21	
2	Material Information (Informacion del Material)			
	Source (Fuente)	Sand Cycloning Plant		
	Work Area (Area de Trabajo)	TMF ESD WRP#5 Cell-12 (In Place / Mechanical Sand)		
	Borrow - Foundation - Excavation - Crusher - Fill - Site Investigation - Other: Plant <i>Prestamo - Fundacion - Excavacion - Crusher - Relleno - Investigacion de Sitio - Otro:</i>			
	Fill Zone (specs 1824-363-CI-SPC-0003): <i>Zona de Material:</i>			
	Material Type <i>Tipo de Material</i>	Tailings Material	Quality Test	
	Remarks: <i>Comentarios:</i>			
	Prueba de doble anillo Punto #1			
		Start sta.:	End Sta.:	
	Coordinates - GPS or Survey <i>(Coordenadas - GPS o Topografia):</i>	N: 979592	E: 539079	
	Depth used to estimate elevation: <i>(Profundidad a la que se tomo la muestra):</i>	150mm		
	Recorded Ground elevation: <i>(Elevacion del terreno)</i>	90.90m		
Technician:	Name: DB / EL		Signature:	
Lab Supervisor:	Name: CG		Signature:	

MINA COBRE PANAMA
Gradation Analysis (ASTM D6913)



Sample Type:

Tailings Material

Technician:

EL

Location:

TMF ESD WRP#5 Cell-12 (In Place / Mechanical Sand)

Sample No:

MPSA-RT-DRI-031

Date Tested:

12-Nov-21

Other:

Prueba de doble anillo Punto #1

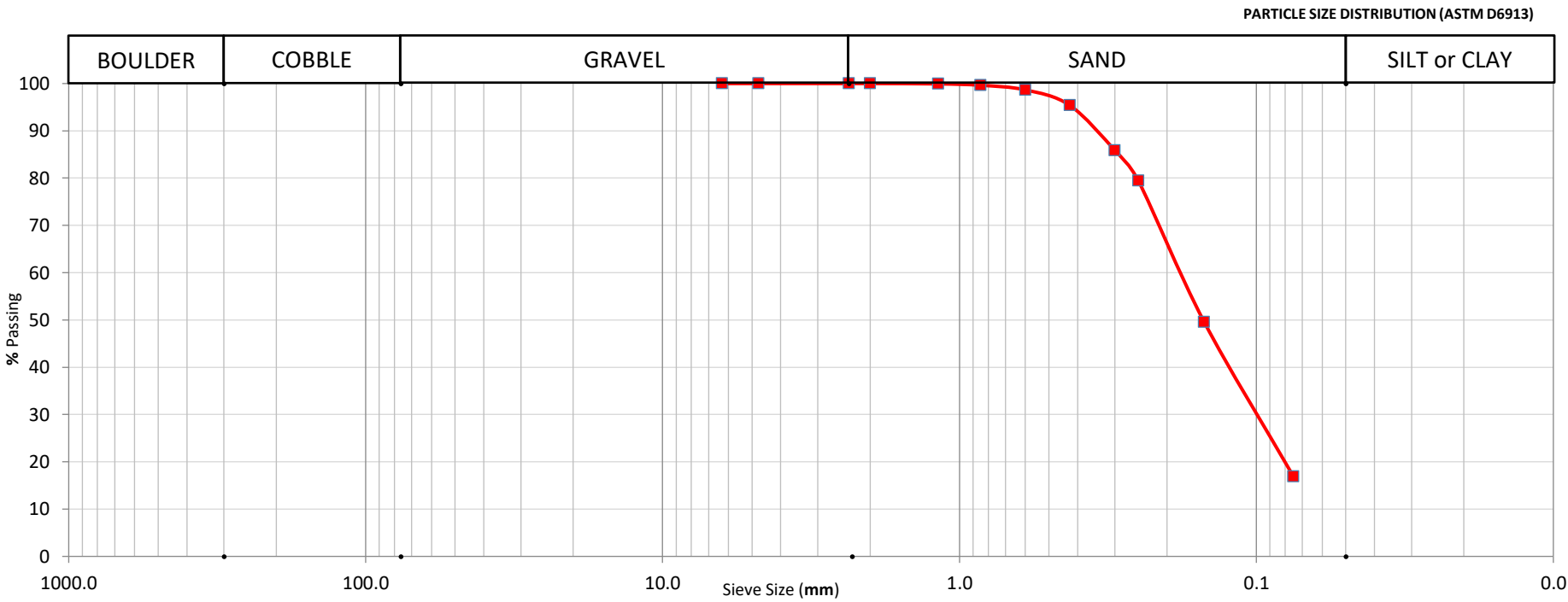
Source:

Sand Cycloning Plant

11-Nov-21

Wet Weight (g):	728.53
Moisture (%):	13.3
Orig. Dry Wt. (g):	643.20
Total Solid (%):	88.3
Washed Oven Dry Wt. (g):	534.60
Washed Loss (g):	108.60
Specific Gravity :	

Gravel	0.0
Sand	83.1
Fines	16.9
Fineness modulus	1.75



Sieve No	Sieve Size (mm)	Coarser Limit	Finer Limit	Ind. Ret. Wt. (g)	Cum. Ret. Wt. (g)	% Retained	% Passing
24"	600.0						
18"	450.0						
12"	300.0						
8"	200.0						
6"	150.0						
5"	125.0						
4"	100.0						
3"	75.0						
2 1/2"	63.0						
2"	50.0						
1.5"	37.5						
1"	25.0						
3/4"	19.0						
1/2"	12.5						
3/8"	9.5						
1/4"	6.3			0.00	0.00	0.0	100.0

Sieve No	Sieve Size (mm)	Coarser Limit	Finer Limit	Ind. Ret. Wt. (g)	Cum. Ret. Wt. (g)	% Retained	% Passing
#4	4.75			0.00	0.00	0.0	100.0
#8	2.36			0.00	0.00	0.0	100.0
#10	2.00			0.00	0.00	0.0	100.0
#16	1.18			0.50	0.50	0.1	99.9
#20	0.85			1.88	2.38	0.4	99.6
#30	0.60			6.27	8.65	1.3	98.7
#40	0.425			21.05	29.70	4.6	95.4
#50	0.30			61.12	90.82	14.1	85.9
#60	0.25			41.29	132.11	20.5	79.5
#100	0.15			192.09	324.20	50.4	49.6
#200	0.075			210.40	534.60	83.1	16.9





11 nov. 2021 10:09:48 a. m.

Sample Identification		 FIRST QUANTUM MINERALS LTD. Cobre Panamá	
1	Informacion General (Informacion General)		
	Sample number (Numero de muestra):	MPSA-SC-189	
	sampled date (Fecha de muestreo):	11-Nov-21	
2	Material Information (Informacion del Material)		
	Source (Fuente)	Sand Cyclone Plan	
	Work Area (Area de Trabajo)	TMF ESD WRP-5 Sand Cell N° 12 Plataforma (In Place)	
	Borrow - Foundation - Excavation - Crusher - Fill - Site Investigation - Other: Prestamo - Fundacion - Excavacion - Crusher - Relleno - Investigacion de Sitio - Otro:		
	Fill Zone (specs 1824-363-CI-SPC-0003): Zona de Material:		
	Material Type Tipo de Material	Cyclone Sand	Density Test cone Method for DRI Test Sand- Test
	Remarks: Comentarios: Received: 11:25hrs		
	Using materials MPSA-RT-19152		
	Stations (along dam center line) Estaciones (Eje de Presa)	Start sta.:	End Sta.:
	Coordinates - GPS or Survey (Coordenadas - GPS o Topografia):	N: 979592	E: 539079
	Depth used to estimate elevation: (Profundidad a la que se tomo la muestra):	130 mm	
	Recorded Ground elevation: (Elevacion del terreno)	90.90m	
Technician:	Name: DB / EL	Signature:	
Lab Supervisor:	Name: CG	Signature:	

Form No. 1824-QC-LST-057 Rv02 Dual language

MINA COBRE PANAMA

Density and Unit Weight of Soil in Place by Sand-Cone Method
(ASTM D1556)



Sample Type:

Cyclone Sand

Technician:

EL

Location:

TMF ESD WRP-5 Sand Cell N° 12
Plataforma (In Place)

Lab. No:

MPSA-SC-189

Date Tested:

11-Nov-21

Source:

Sand Cyclone Plan

Fill Material Ref. No.:

19152

Date Sampled:

11-Nov-21

		130mm				
Coordinate (N, E)		979592 539079				
Elevation (m)		90.90 m				
Test Hole Volume Determination						
Sand Cone Apparatus No.		1	1			
A. Mass of Sand in Container, Bef. Pouring (g)		6400				
B. Mass of Sand in Containerl, Aft. Pouring (g)		719				
C. Mass of Sand in Funnel & Hole (g) (A-B)		5681				
D. Mass of Sand in Funnel (g) (frm Calib.)		1751				
E. Mass of Sand in Hole (g) (C-D)		3930				
F. Bulk Density of Sand (cm ³ /g) (frm Calib)		1.519				
G. Vol. of Test Hole (cm ³) (E/F)		2587				
Water Content Determination (Laboratory)						
Method Used	D2216	☒	☐	☐	☐	☐
	D4643	☐	☐	☐	☐	☐
	D4959	☒	☒	☐	☐	☐
H. Mass of Container (g)		0				
I. Mass of Container+Moist Specimen (g)		608				
J. Mass of Container+Dry Specimen (g)		532				
K. Mass of Water (g) (I-J)		75				
L. Mass of Dry Specimen (g) (J-H)		532				
M. Water Content (%) (K/L)*100)		14.1				
Wet & Dry Density Determination (in-place)						
N. Moist Mass of Material from Hole (kg)		4921				
O. Dry Mass of Material from Hole (kg)		4309				
P. Wet Density of Tested Material (kg/m ³) (N/G)		1.902				
Q. Dry Density of Tested Material (Kg/m ³) (O/G)		1.665				
R. In-Situ Compaction (%) (Q/S)*100		108.6				
Laboratory Compaction						
S. Max. Dry Density (kg/m ³)		1.533				
T. Opt. Moist. Cont. (%)		19.7				

[illegible]

Date:	11-Nov-21	Location: TMF ESD WRP 5 Sand Cell N#12	N	979592
Sample ID:	MPSA-PERM-031		E	539079
Material:	Cyclone U/F Sand (Mechanical Placement)		Elev.(m)	90.90 m
Fines Content:	16.9%			
Source:	Sand Cycloning Plant			
Technician:	DB / EL	Date Tested	12-Nov-21	

Enter Data

SPECIFICATION: > 1.00E-04 cm/s

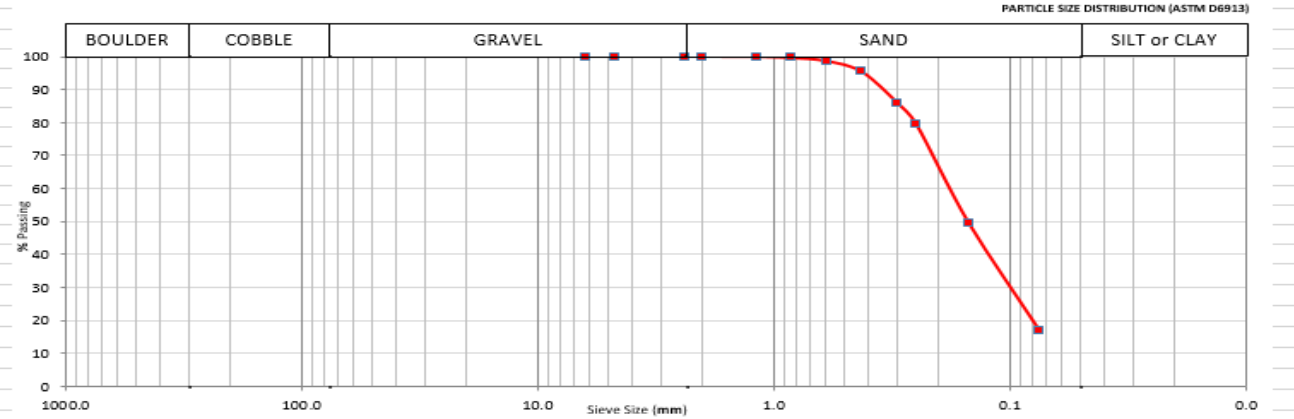
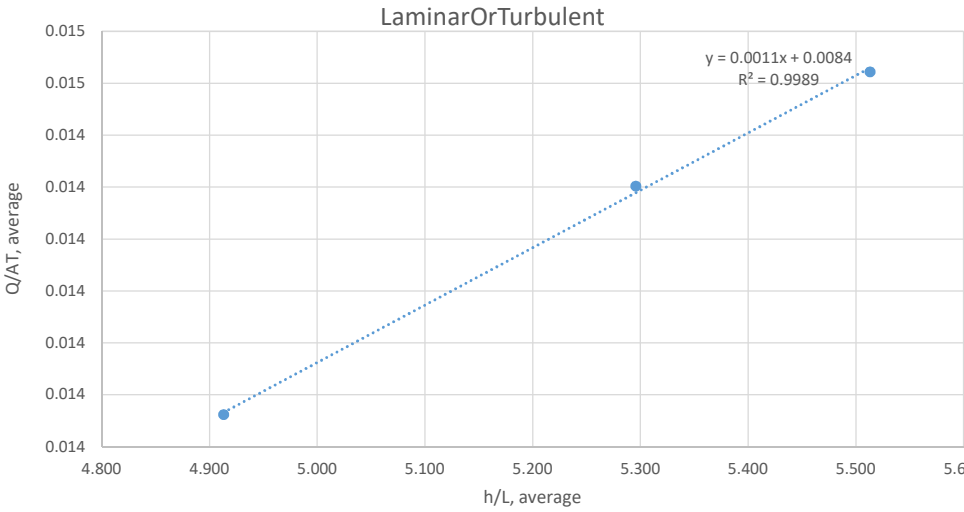
Viscosity Factor (v22/v20)=	0.6036685642
Viscosity Factor (v23/v20)=	0.5895635674
Viscosity Factor (v25/v20)=	0.5629348514

Flow Laminarity	Test	H1 (cm)	H2 (cm)	h (cm)	Q (cm3, mL)	t (s)	Q/At	Average Q/At	h/L	Average, h/L	T (°C)	k, cm/s	k, m/s	k, m/s, corrected	Average k, m/s, corrected	Average k, cm/s, corrected
0 height	1	92.8	29.4	63.4	44	30	0.014521	0.015	5.513043478	5.513	22	2.63E-03	2.63402E-05	1.59007E-05	1.59007E-05	1.5901E-03
	2	92.8	29.4	63.4	44	30	0.014521		5.513043478		22	2.63E-03	2.63402E-05	1.59007E-05		
	3	92.8	29.4	63.4	44	30	0.014521		5.513043478		22	2.63E-03	2.63402E-05	1.59007E-05		
Δ5cm height	4	93.5	32.6	60.9	43	30	0.014191	0.014	5.295652174	5.296	22	2.68E-03	2.67982E-05	1.61773E-05	1.63027E-05	1.6303E-03
	5	93.5	32.6	60.9	43	30	0.014191		5.295652174		22	2.68E-03	2.67982E-05	1.61773E-05		
	6	93.5	32.6	60.9	44	30	0.014521		5.295652174		22	2.74E-03	2.74215E-05	1.65535E-05		
Δ10cm height	7	93.6	37.1	56.5	42	30	0.013861	0.014	4.913043478	4.913	22	2.82E-03	2.82134E-05	1.70316E-05	1.70316E-05	1.7032E-03
	8	93.6	37.1	56.5	42	30	0.013861		4.913043478		22	2.82E-03	2.82134E-05	1.70316E-05		
	9	93.5	37	56.5	42	30	0.013861		4.913043478		22	2.82E-03	2.82134E-05	1.70316E-05		

MDD (g/cm3)	1.533
OMC	19.70

Area (cm2)=	101.00
Length between manometers (cm)=	11.50
Mass (perm.), g	2204.00
100% Compaction Height of Specimen (cm)	18.00
Final Height of Specimen (cm)	18.00
V (perm., cm3) at 18cm height	1818.00
Specimen Moisture Cntnt	19.70
Mass (wet) required for 6x 3cm compacted layers at 100% PRMDD	3336.03
Mass Final of Compacted Specimen	3337.80
Final Volume of Specimen (cm3)	1818.00
Dry Unit Weight	1.534
% Compaction	100.1

Void Ratio, e
Reltive Density, RD



Sieve No	Sieve Size (mm)	Coarse r Limit	Finer Limit	Ind. Ret. w/t. (g)	Cum. Ret. w/t. (g)	% Retained	% Passing
24"	600.0						
18"	450.0						
12"	300.0						
8"	200.0						
6"	150.0						
5"	125.0						
4"	100.0						
3"	75.0						
2 1/2"	63.0						
2"	50.0						
1.5"	37.5						
1"	25.0						
3/4"	19.0						
1/2"	12.5						
3/8"	9.5						
1/4"	6.3			0.00	0.00	0.0	100.0

Sieve No	Sieve Size (mm)	Coarse r Limit	Finer Limit	Ind. Ret. w/t. (g)	Cum. Ret. w/t. (g)	% Retained	% Passing
#4	4.75			0.00	0.00	0.0	100.0
#8	2.36			0.00	0.00	0.0	100.0
#10	2.00			0.00	0.00	0.0	100.0
#16	1.18			0.50	0.50	0.1	99.9
#20	0.85			1.88	2.38	0.4	99.6
#30	0.60			6.27	8.65	1.3	98.7
#40	0.425			21.05	29.70	4.6	95.4
#50	0.30			61.12	90.82	14.1	85.9
#60	0.25			41.29	132.11	20.5	79.5
#100	0.15			192.09	324.20	50.4	49.6
#200	0.075			210.40	534.60	83.1	16.9

Sample Identification		 FIRST QUANTUM MINERALS LTD.		Cobre Panamá
1	Informacion General (Informacion General)			
	Sample number (Numero de muestra):		MPSA-RT-DRI-032	
	sampled date (Fecha de muestreo:)		11-Nov-21	
2	Material Information (Informacion del Material)			
	Source (Fuente)	Sand Cycloning Plant		
	Work Area (Area de Trabajo)	TMF ESD WRP#5 Cell-12 (In Place / Mechanical Sand)		
	Borrow - Foundation - Excavation - Crusher - Fill - Site Investigation - Other: Plant <i>Prestamo - Fundacion - Excavacion - Crusher - Relleno - Investigacion de Sitio - Otro:</i>			
	Fill Zone (specs 1824-363-CI-SPC-0003): <i>Zona de Material:</i>			
	Material Type <i>Tipo de Material</i>	Tailings Material		Quality Test
	Remarks: <i>Comentarios:</i>			
	Prueba de doble anillo Punto #2			
		Start sta.:		End Sta.:
	Coordinates - GPS or Survey <i>(Coordenadas - GPS o Topografia):</i>	N: 979605		E: 539053
	Depth used to estimate elevation: <i>(Profundidad a la que se tomo la muestra):</i>	150mm		
	Recorded Ground elevation: <i>(Elevacion del terreno)</i>	91.23m		
Technician:	Name: DB / EL		Signature:	
Lab Supervisor:	Name: CG		Signature:	

Project Identification: MP5A Cobre TMF				Constants		Area cm2	Depth of Liquid (cm)	Liquid Container Number	Marriotte Tube Volume		Marriotte Tube Area		
Test Location: TMF ESD WRP-5 Sand Cell NP12 (N079605, ES39053 Z-91.23m) Mechanical Sand				Inner Ring		729	15.0		3000		54		
Liquid Used: H2O pH: N/A				Annular Space		2189	15.0		10000		167		
Tested By: D Barrios / E. Lorenzo				Liquid level maintained using:		() Flow Valve () Float Valve (X) Marriotte Tubes							
Fines % 11.0						15cm Penetration Depth of Outer Ring:							
Trial #	Start / End	Date MM/DD/YY	Time HR:MIN	Elapsed Time Chg/(Total) Min	Flow Readings			Infiltration Rate			Ground Temperature		Remarks
					Inner Ring Reading cm	Inner Marriotte Tube Flow (ml)	Annular Space Reading cm	Annular Space Marriotte Tube Flow (ml)	Liquid Temp C	Inner Infiltration Rate cm/h	Inner Infiltration Rate cm/s	Annular Infiltration Rate cm/h	
1	Start Test	11/11/21	0:00:00		58.5		56.2	28.9					Annular Ring H2O Depth Initial: 15cm
	End Test	11/11/21	0:00:30	0:00:30	57.5	54	55.0	28.9	8.863	2.462E-03	11.013	3.059E-03	28.9 Inner Ring H2O Depth Initial: 15cm
2	Start Test	11/11/21	0:00:30	0:00:30	57.5		55.0	28.9					
	End Test	11/11/21	0:01:00	0:01:00	56.5	54	54.0	28.9	8.863	2.462E-03	9.178	2.549E-03	
3	Start Test	11/11/21	0:01:00	0:00:30	56.5		54.0	28.9					Annular Ring H2O Depth Final: 1.0cm
	End Test	11/11/21	0:01:30	0:01:30	55.4	59	53.0	28.9	9.750	2.708E-03	9.178	2.549E-03	Inner Ring H2O Depth Final: 1.0cm
4	Start Test	11/11/21	0:01:30	0:00:30	55.4		53.0	28.9					
	End Test	11/11/21	0:02:00	0:02:00	54.3	59	51.9	28.9	9.750	2.708E-03	10.095	2.804E-03	
5	Start Test	11/11/21	0:02:00	0:00:30	54.3		51.9	28.9					Weather conditions: Sunny hot weather
	End Test	11/11/21	0:02:30	0:02:30	53.0	70	50.8	28.9	11.523	3.201E-03	10.095	2.804E-03	
6	Start Test	11/11/21	0:02:30	0:00:30	53.0		50.8	28.9					Weather Temp: 28.9°C
	End Test	11/11/21	0:03:00	0:03:00	51.9	59	49.8	28.9	9.750	2.708E-03	9.178	2.549E-03	
7	Start Test	11/11/21	0:03:00	0:00:30	51.9		49.8	28.9					
	End Test	11/11/21	0:03:30	0:03:30	50.9	54	48.7	28.9	8.863	2.462E-03	10.095	2.804E-03	
8	Start Test	11/11/21	0:03:30	0:00:30	50.9		48.7	28.9					Nuclear Density Test
	End Test	11/11/21	0:04:00	0:04:00	49.7	65	47.8	28.9	10.636	2.954E-03	8.260	2.294E-03	
9	Start Test	11/11/21	0:04:00	0:00:30	49.7		47.8	28.9					W.D: 1785 kg/m3
	End Test	11/11/21	0:04:30	0:04:30	48.6	59	46.6	28.9	9.750	2.708E-03	11.013	3.059E-03	
10	Start Test	11/11/21	0:04:30	0:00:30	48.6		46.6	28.9					D.D: 1584 kg/m3
	End Test	11/11/21	0:05:00	0:05:00	47.6	54	45.6	28.9	8.863	2.462E-03	9.178	2.549E-03	
11	Start Test	11/11/21	0:05:00	0:00:30	47.6		45.6	28.9					M.C: 12.7%
	End Test	11/11/21	0:05:30	0:05:30	46.5	59	44.5	28.9	9.750	2.708E-03	10.095	2.804E-03	
12	Start Test	11/11/21	0:05:30	0:00:30	46.5		44.5	28.9					Compaction: 103.2%
	End Test	11/11/21	0:06:00	0:06:00	45.5	54	43.5	28.9	8.863	2.462E-03	9.178	2.549E-03	
13	Start Test	11/11/21	0:06:00	0:00:30	45.5		43.5	28.9					(Using MP5A-RT-19487 Standard Lab. Compaction M.D.D: 1535 -O.M.C: 20.3%)
	End Test	11/11/21	0:06:30	0:06:30	44.5	54	42.5	28.9	8.863	2.462E-03	9.178	2.549E-03	Hydraulic Sand
14	Start Test	11/11/21	0:06:30	0:00:30	44.5		42.5	28.9					
	End Test	11/11/21	0:07:00	0:07:00	43.5	54	41.4	28.9	8.863	2.462E-03	10.095	2.804E-03	
15	Start Test	11/11/21	0:07:00	0:00:30	43.5		41.4	28.9					
	End Test	11/11/21	0:07:30	0:07:30	42.4	59	40.4	28.9	9.750	2.708E-03	9.178	2.549E-03	
16	Start Test	11/11/21	0:07:30	0:00:30	42.4		40.4	28.9					
	End Test	11/11/21	0:08:00	0:08:00	41.5	48	39.3	28.9	7.977	2.216E-03	10.095	2.804E-03	
17	Start Test	11/11/21	0:08:00	0:00:30	41.5		39.3	28.9					
	End Test	11/11/21	0:08:30	0:08:30	40.5	54	38.3	28.9	8.863	2.462E-03	9.178	2.549E-03	
18	Start Test	11/11/21	0:08:30	0:00:30	40.5		38.3	28.9					
	End Test	11/11/21	0:09:00	0:09:00	39.6	48	37.3	28.9	7.977	2.216E-03	9.178	2.549E-03	
19	Start Test	11/11/21	0:09:00	0:00:30	39.6		37.3	28.9					
	End Test	11/11/21	0:09:30	0:09:30	38.5	59	36.2	28.9	9.750	2.708E-03	10.095	2.804E-03	
20	Start Test	11/11/21	0:09:30	0:00:30	38.5		36.2	28.9					
	End Test	11/11/21	0:10:00	0:10:00	37.6	48	35.1	28.9	7.977	2.216E-03	10.095	2.804E-03	
21	Start Test	11/11/21	0:10:00	0:00:30	37.6		35.1	28.9					
	End Test	11/11/21	0:10:30	0:10:30	36.7	48	34.0	28.9	7.977	2.216E-03	10.095	2.804E-03	
22	Start Test	11/11/21	0:10:30	0:00:30	36.7		34.0	28.9					
	End Test	11/11/21	0:11:00	0:11:00	35.7	54	33.0	28.9	8.863	2.462E-03	9.178	2.549E-03	
23	Start Test	11/11/21	0:11:00	0:00:30	35.7		33.0	28.9					
	End Test	11/11/21	0:11:30	0:11:30	34.8	48	31.9	28.9	7.977	2.216E-03	10.095	2.804E-03	
24	Start Test	11/11/21	0:11:30	0:00:30	34.8		31.9	28.9					
	End Test	11/11/21	0:12:00	0:12:00	33.8	54	30.9	28.9	8.863	2.462E-03	9.178	2.549E-03	
25	Start Test	11/11/21	0:12:00	0:00:30	33.8		30.9	28.9					
	End Test	11/11/21	0:12:30	0:12:30	32.9	48	29.8	28.9	7.977	2.216E-03	10.095	2.804E-03	
26	Start Test	11/11/21	0:12:30	0:00:30	32.9		29.8	28.9					
	End Test	11/11/21	0:13:00	0:13:00	31.9	54	28.8	28.9	8.863	2.462E-03	9.178	2.549E-03	
27	Start Test	11/11/21	0:13:00	0:00:30	31.9		28.8	28.9					
	End Test	11/11/21	0:13:30	0:13:30	31.0	48	27.5	28.9	7.977	2.216E-03	11.931	3.314E-03	
28	Start Test	11/11/21	0:13:30	0:00:30	31.0		27.5	28.9					
	End Test	11/11/21	0:14:00	0:14:00	30.3	38	26.5	28.9	6.204	1.723E-03	9.178	2.549E-03	
29	Start Test	11/11/21	0:14:00	0:00:30	30.3		26.5	28.9					
	End Test	11/11/21	0:14:30	0:14:30	29.4	48	25.5	28.9	7.977	2.216E-03	9.178	2.549E-03	
30	Start Test	11/11/21	0:14:30	0:00:30	29.4		25.5	28.9					
	End Test	11/11/21	0:15:00	0:15:00	28.5	48	24.4	28.9	7.977	2.216E-03	10.095	2.804E-03	
31	Start Test	11/11/21	0:15:00	0:00:30	28.5		24.4	28.9					
	End Test	11/11/21	0:15:30	0:15:30	27.5	54	23.4	28.9	8.863	2.462E-03	9.178	2.549E-03	
32	Start Test	11/11/21	0:15:30	0:00:30	27.5		23.4	28.9					
	End Test	11/11/21	0:16:00	0:16:00	26.6	48	22.4	28.9	7.977	2.216E-03	9.178	2.549E-03	
33	Start Test	11/11/21	0:16:00	0:00:30	26.6		22.4	28.9					
	End Test	11/11/21	0:16:30	0:16:30	25.7	48	21.3	28.9	7.977	2.216E-03	10.095	2.804E-03	
34	Start Test	11/11/21	0:16:30	0:00:30	25.7		21.3	28.9					
	End Test	11/11/21	0:17:00	0:17:00	24.9	43	20.2	28.9	7.091	1.970E-03	10.095	2.804E-03	
35	Start Test	11/11/21	0:17:00	0:00:30	24.9		20.2	28.9					
	End Test	11/11/21	0:17:30	0:17:30	24.0	48	19.1	28.9	7.977	2.216E-03	10.095	2.804E-03	
36	Start Test	11/11/21	0:17:30	0:00:30	24.0		19.1	28.9					
	End Test	11/11/21	0:18:00	0:18:00	23.5	27	18.0	28.9	4.432	1.231E-03	10.095	2.804E-03	
37	Start Test	11/11/21	0:18:00	0:00:30	23.5		18.0	28.9					
	End Test	11/11											

MINA COBRE PANAMA
Gradation Analysis (ASTM D6913)



Sample Type:

Tailings Material

Technician:

EL

Sample No:

MPSA-RT-DRI-032

Date Tested:

12-Nov-21

Source:

Sand Cycloning Plant

11-Nov-21

Location:

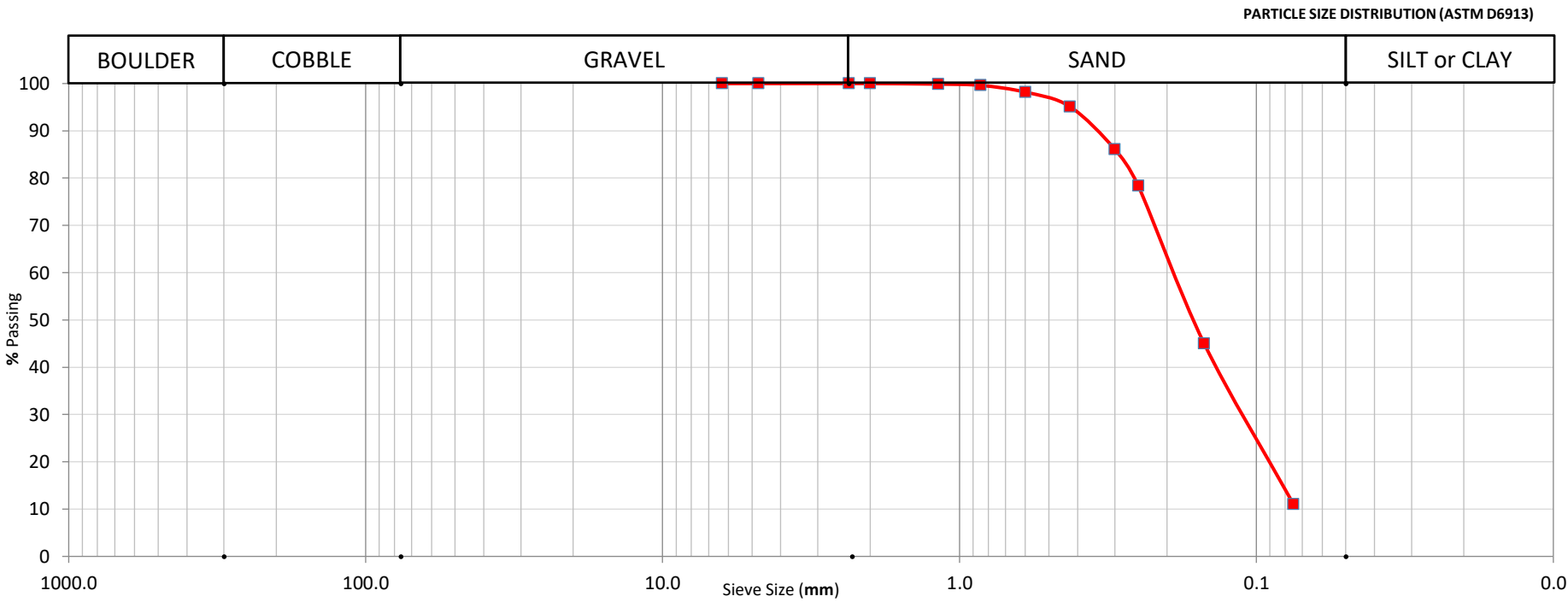
TMF ESD WRP#5 Cell-12 (In Place / Mechanical Sand)

Other:

Prueba de doble anillo Punto #2

Wet Weight (g):	570.86
Moisture (%):	11.9
Orig. Dry Wt. (g):	510.10
Total Solid (%):	89.4
Washed Oven Dry Wt. (g):	453.83
Washed Loss (g):	56.27
Specific Gravity :	

Gravel	0.0
Sand	89.0
Fines	11.0
Fineness modulus	1.87



Sieve No	Sieve Size (mm)	Coarser Limit	Finer Limit	Ind. Ret. Wt. (g)	Cum. Ret. Wt. (g)	% Retained	% Passing
24"	600.0						
18"	450.0						
12"	300.0						
8"	200.0						
6"	150.0						
5"	125.0						
4"	100.0						
3"	75.0						
2 1/2"	63.0						
2"	50.0						
1.5"	37.5						
1"	25.0						
3/4"	19.0						
1/2"	12.5						
3/8"	9.5						
1/4"	6.3			0.00	0.00	0.0	100.0

Sieve No	Sieve Size (mm)	Coarser Limit	Finer Limit	Ind. Ret. Wt. (g)	Cum. Ret. Wt. (g)	% Retained	% Passing
#4	4.75			0.00	0.00	0.0	100.0
#8	2.36			0.00	0.00	0.0	100.0
#10	2.00			0.00	0.00	0.0	100.0
#16	1.18			0.64	0.64	0.1	99.9
#20	0.85			1.34	1.98	0.4	99.6
#30	0.60			7.30	9.28	1.8	98.2
#40	0.425			15.56	24.84	4.9	95.1
#50	0.30			45.99	70.83	13.9	86.1
#60	0.25			39.63	110.46	21.7	78.3
#100	0.15			169.99	280.45	55.0	45.0
#200	0.075			173.38	453.83	89.0	11.0









11 nov. 2021 5:06:04 p. m.

Sample Identification		 FIRST QUANTUM MINERALS LTD. Cobre Panamá	
1	Informacion General (Informacion General)		
	Sample number (Numero de muestra):	MPSA-SC-191	
	sampled date (Fecha de muestreo:)	11-Nov-21	
2	Material Information (Informacion del Material)		
	Source (Fuente)	Sand Cyclone Plan	
	Work Area (Area de Trabajo)	TMF ESD WRP-5 Sand Cell N° 12 Plataforma (In Place)	
	Borrow - Foundation - Excavation - Crusher - Fill - Site Investigation - Other: Prestamo - Fundacion - Excavacion - Crusher - Relleno - Investigacion de Sitio - Otro:		
	Fill Zone (specs 1824-363-CI-SPC-0003): Zona de Material:		
	Material Type Tipo de Material	Cyclone Sand	Density Test cone Method for DRI Test Sand- Test
	Remarks: Comentarios: Received: 17:30hrs		
	Using materials MPSA-RT-19487		
	Stations (along dam center line) Estaciones (Eje de Presa)	Start sta.:	End Sta.:
	Coordinates - GPS or Survey (Coordenadas - GPS o Topografia):	N: 979605	E: 539053
	Depth used to estimate elevation: (Profundidad a la que se tomo la muestra):	130 mm	
	Recorded Ground elevation: (Elevacion del terreno)	91.23m	
Technician:	Name: DB / EL	Signature:	
Lab Supervisor:	Name: CG	Signature:	

Form No. 1824-QC-LST-057 Rv02 Dual language

MINA COBRE PANAMA

Density and Unit Weight of Soil in Place by Sand-Cone Method
(ASTM D1556)



Sample Type: **Cyclone Sand**

Technician: **DB**

Location: **TMF ESD WRP-5 Sand Cell N° 12
Plataforma (In Place)**

Lab. No: **MPSA-SC-191**

Date Tested: **11-Nov-21**

Source: **Sand Cyclone Plan**

Fill Material Ref. No.: **19487**

Date Sampled: **11-Nov-21**

		130mm					
Coordinate (N, E)		979605 539053					
Elevation (m)		91.23m					
Test Hole Volume Determination							
Sand Cone Apparatus No.		1	1				
A. Mass of Sand in Container, Bef. Pouring (g)		6453					
B. Mass of Sand in Containerl, Aft. Pouring (g)		973					
C. Mass of Sand in Funnel & Hole (g) (A-B)		5480					
D. Mass of Sand in Funnel (g) (frm Calib.)		1751					
E. Mass of Sand in Hole (g) (C-D)		3729					
F. Bulk Density of Sand (cm ³ /g) (frm Calib)		1.519					
G. Vol. of Test Hole (cm ³) (E/F)		2455					
Water Content Determination (Laboratory)							
Method Used	D2216	☒	☐	☐	☐	☐	☐
	D4643	☐	☐	☐	☐	☐	☐
	D4959	☒	☒	☐	☐	☐	☐
H. Mass of Container (g)		345					
I. Mass of Container+Moist Specimen (g)		666					
J. Mass of Container+Dry Specimen (g)		532					
K. Mass of Water (g) (I-J)		36					
L. Mass of Dry Specimen (g) (J-H)		321					
M. Water Content (%) (K/L)*100)		11.2					
Wet & Dry Density Determination (in-place)							
N. Moist Mass of Material from Hole (kg)		4384					
O. Dry Mass of Material from Hole (kg)		3942					
P. Wet Density of Tested Material (kg/m ³) (N/G)		1.786					
Q. Dry Density of Tested Material (Kg/m ³) (O/G)		1.606					
R. In-Situ Compaction (%) (Q/S)*100		104.6					
Laboratory Compaction							
S. Max. Dry Density (kg/m ³)		1.535					
T. Opt. Moist. Cont. (%)		20.3					

linea Panama

[illegible]

Date:	11-Nov-21	Location: TMF ESD WRP 5 Sand Cell N#12		N	979605
Sample ID:	MPSA-PERM-032			E	539053
Material:	Cyclone U/F Sand (Mechanical Placement)			Elev.(m)	91.23 m
Fines Content:	11.0%				
Source:	Sand Cycloning Plant				
Technician:	YG / DB	Date Tested	12-Nov-21		

Enter Data

SPECIFICATION: > 1.00E-04 cm/s

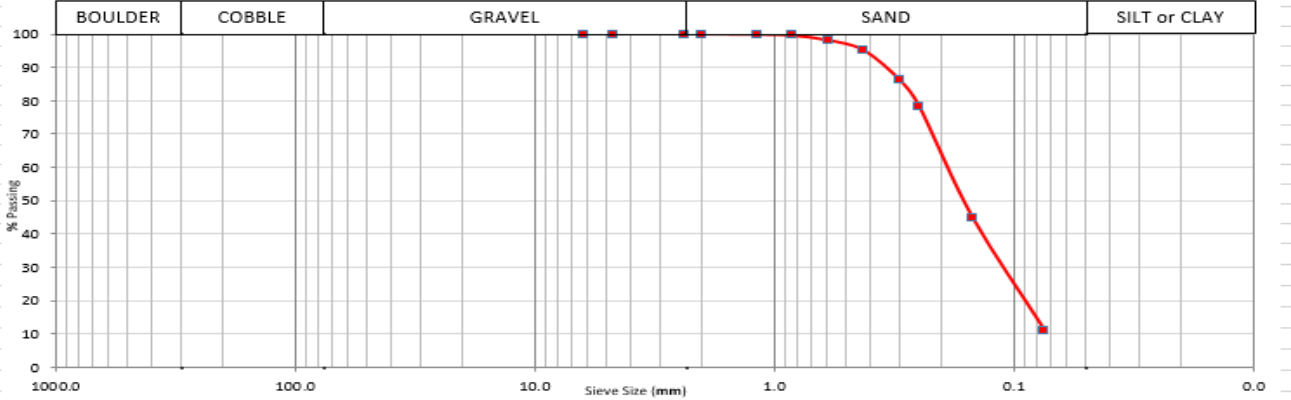
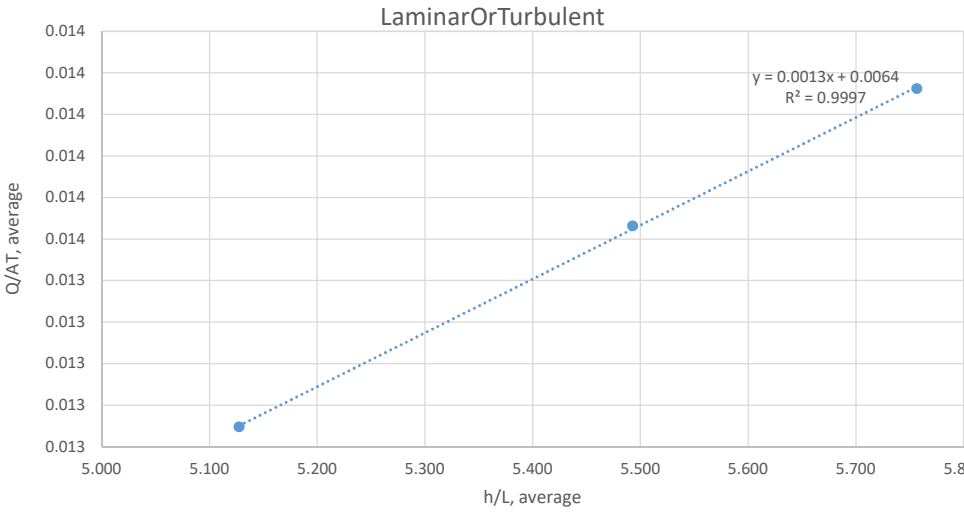
Viscosity Factor (v22/v20)=	0.6036685642
Viscosity Factor (v23/v20)=	0.5895635674
Viscosity Factor (v24/v20)=	0.5760278305

Flow Laminarity	Test	H1 (cm)	H2 (cm)	h (cm)	Q (cm3, mL)	t (s)	Q/At	Average Q/At	h/L	Average, h/L	T (°C)	k, cm/s	k, m/s	k, m/s, corrected	Average k, m/s, corrected	Average k, cm/s, corrected
0 height	1	87.5	21.3	66.2	42	30	0.013861	0.014	5.756521739	5.757	22	2.41E-03	2.40794E-05	1.45360E-05	1.44228E-05	1.4423E-03
	2	87.5	21.3	66.2	42	30	0.013861		5.756521739		22	2.41E-03	2.40794E-05	1.45360E-05		
	3	87.5	21.3	66.2	42	30	0.013861		5.756521739		23	2.41E-03	2.40794E-05	1.41964E-05		
Δ5cm height	4	88.7	25.5	63.2	41	30	0.013531	0.014	5.495652174	5.493	23	2.46E-03	2.46219E-05	1.45162E-05	1.44126E-05	1.4413E-03
	5	88.7	25.5	63.2	41	30	0.013531		5.495652174		23	2.46E-03	2.46219E-05	1.45162E-05		
	6	88.7	25.6	63.1	41	30	0.013531		5.486956522		24	2.47E-03	2.46609E-05	1.42054E-05		
Δ10cm height	7	89.7	30.7	59.0	39.3	30	0.01297	0.013	5.130434783	5.128	24	2.53E-03	2.52811E-05	1.45626E-05	1.46574E-05	1.4657E-03
	8	89.7	30.7	59.0	39.5	30	0.013036		5.130434783		24	2.54E-03	2.54097E-05	1.46367E-05		
	9	89.7	30.8	58.9	39.8	30	0.013135		5.12173913		24	2.56E-03	2.56462E-05	1.47729E-05		

MDD (g/cm3)	1.535
OMC	20.30

Area (cm2)=	101.00
Length between manometers (cm)=	11.50
Mass (perm.), g	2204.00
100% Compaction Height of Specimen (cm)	18.00
Final Height of Specimen (cm)	18.00
V (perm., cm3) at 18cm height	1818.00
Specimen Moisture Cntnt	19.70
Mass (wet) required for 6x 3cm compacted layers at 100% PRMDD	3340.38
Mass Final of Compacted Specimen	3339.60
Final Volume of Specimen (cm3)	1818.00
Dry Unit Weight	1.535
% Compaction	100.0

Void Ratio, e
Reltive Density, RD



Sieve No	Sieve Size (mm)	Coarse r Limit	Finer Limit	Ind. Ret. w/t. (g)	Cum. Ret. w/t. (g)	% Retained	% Passing
24"	600.0						
18"	450.0						
12"	300.0						
8"	200.0						
6"	150.0						
5"	125.0						
4"	100.0						
3"	75.0						
2 1/2"	63.0						
2"	50.0						
1.5"	37.5						
1"	25.0						
3/4"	19.0						
1/2"	12.5						
3/8"	9.5						
1/4"	6.3			0.00	0.00	0.0	100.0

Sieve No	Sieve Size (mm)	Coarse r Limit	Finer Limit	Ind. Ret. w/t. (g)	Cum. Ret. w/t. (g)	% Retained	% Passing
#4	4.75			0.00	0.00	0.0	100.0
#8	2.36			0.00	0.00	0.0	100.0
#10	2.00			0.00	0.00	0.0	100.0
#16	1.18			0.64	0.64	0.1	99.9
#20	0.85			1.34	1.98	0.4	99.6
#30	0.60			7.30	9.28	1.8	98.2
#40	0.425			15.56	24.84	4.9	95.1
#50	0.30			45.99	70.83	13.9	86.1
#60	0.25			39.63	110.46	21.7	78.3
#100	0.15			169.99	280.45	55.0	45.0
#200	0.075			173.38	453.83	89.0	11.0